Creating
Coastal Stewardship
through Science

Defining Habitats

at Point Reyes National Seashore

2000 First Edition

6th–8th GRADES

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EXXON

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Point Reyes National Seashore Association

Publishing Information

This curriculum guide was funded with grants through the National Park Foundation.

The listing of a resource in this curriculum does not presume its endorsement by the National Park Service.

This guide may be obtained by participating in a teacher workshop at Point Reyes National Seashore or through a teacher in-service training at your school.

Teachers are encouraged to offer their feedback by filling out the enclosed evaluation form or contacting Point Reyes National Seashore directly.


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Preface

The intent of these guides is to provide middle school students with the opportunity to observe natural processes at Point Reyes National Seashore so they might take a greater interest in environmental stewardship and science. Teachers from fifteen area schools developed and field-tested seven "Creating Coastal Stewardship through Science" guides for classroom and field trip use. Each guide is carefully designed to facilitate a hands-on learning experience using science and the environment. Natural resources such as Pacific gray whales, northern elephant seals, tule elk, California quail, Douglas iris, and the San Andreas Fault are highlighted because they are easy to identify and to observe. All activities are linked to the California State Science Standards (2000) and the National Science Standards.

You may use this guide alone or in conjunction with other guides. We highly recommend that whenever you use a guide, you use the pre-visit activities to fully prepare the students for the field trip. These activities address student safety, wildlife observation techniques, equipment use, field journal development, and concepts that need to be taught prior to the park visit. Use of the post-visit activities is also critical to the learning process because they guide the students in making scientific deductions and in developing their environmental stewardship ethics.

Following this preface, you will find background information on the National Park Service and an overview of Point Reyes National Seashore. To provide your students with a better understanding of the place that they will be visiting, we recommend that you share this information with them. For an in-depth overview of the National Park Service, visit our website at ***www.nps.gov***.

Point Reyes National Seashore provides outstanding opportunities for learning about natural and cultural resources. There are also exceptional educational opportunities provided by Park partners such as the Point Reyes Bird Observatory, Audubon Canyon Ranch, and Point Reyes National Seashore Association. To learn more about the Park and our partners, visit our website at ***www.nps.gov/pore***.

The National Park Service

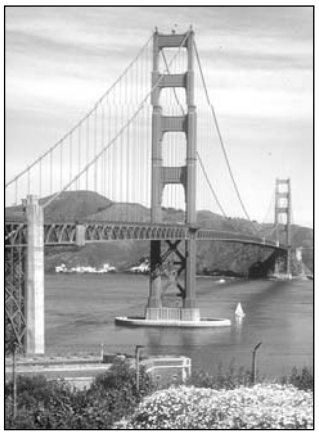
The National Park Service cares for special places saved by the American people so that all may experience our heritage.

Experience Your America


Olympic National Park

On August 25, 1916, President Woodrow Wilson signed the act creating the National Park Service, a new federal bureau in the Department of the Interior responsible for protecting the 40 national parks and monuments then in existence and those yet to be established.

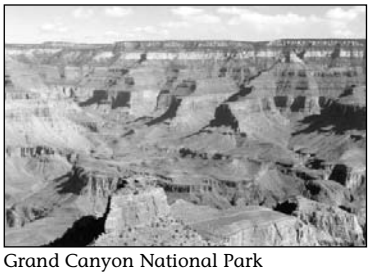
This "Organic Act" of 1916 states that "the Service thus established shall promote and regulate the use of Federal areas known as national parks, monuments and reservations . . . by such means and measures as conform to the fundamental purpose of the said parks, monuments and reservations, which purpose is to conserve the scenery and the natural and historic objects and the wild life therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations."


Golden Gate National Recreation Area

The National Park Service still strives to meet these original goals, while filling many other roles as well: guardian of our diverse cultural and recreational resources; environmental advocate; world leader in the parks and preservation community; and pioneer in the drive to protect America's open space.


Mesa Verde National Park

The National Park System of the United States comprises over 379 areas covering more than 83 million acres in 49 states, the District of Columbia, American Samoa, Guam, Puerto Rico, Saipan, and the Virgin Islands. Although not all parks are as well known as the Grand Canyon and Yellowstone, all are areas of such national significance that they have been included in the National Park Service—ancient ruins, battlefields, birthplaces, memorials, recreation areas, and countless other wonders. Point Reyes National Seashore is one of ten national seashores.


Grand Canyon National Park

The future of the National Park System lies in understanding and protecting its meanings, values, and resources. Each part of the system represents the United States and a part of our heritage. Preservation of individual sites and the entire system will ensure the essence of quality remains in our lives and the lives of all future generations.

Point Reyes National Seashore


Bruce Farnsworth

Point Reyes National Seashore was established to preserve and protect the natural and cultural features and natural ecosystems along the diminishing undeveloped coastline of the western United States. Located just an hour's drive from a densely populated metropolitan area, the Seashore is a sanctuary for countless plant and animal species. With half of Point Reyes National Seashore designated as wilderness, it provides a sanctuary for the human spirit—for discovery, inspiration, solitude, and recreation—and a reminder of the human connection to the land.

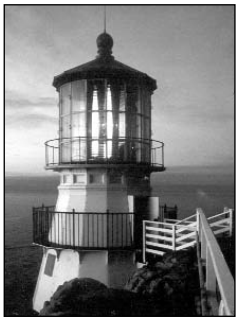

Sue Van Der Wahl

Point Reyes National Seashore comprises over 71,000 acres, including 32,000 acres of wilderness area. Estuaries, windswept beaches, coastal scrub, coastal grasslands, salt marshes, and coniferous forests create a haven of 80 miles of unspoiled and undeveloped coastline located just an hour's drive from an urban area populated by seven million people. Abundant recreational opportunities include 140 miles of hiking trails, backcountry campgrounds, and numerous beaches.

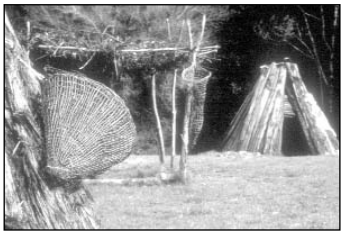
The San Andreas Fault separates the Point Reyes Peninsula from the rest of the North American continent. Granite bedrock found here and not found again until the Sierra Nevada range suggests the peninsula is geologically dynamic. According to geologists, the land that is now called Point Reyes has moved some 300 miles northwest over a period of 100 million years and is still moving.


Rich Stallcup

As wildland habitat is developed elsewhere in California, the relevance of Point Reyes as a protected area with a notably rich biological diversity increases. Over 45% of North American avian species and nearly 18% of California's plant species are found here. Point Reyes also contains some examples of the world's major ecosystem types. For this reason, and because Point Reyes is dedicated to the conservation of nature and scientific research, it was recognized in 1988 by the United Nations Educational, Scientific, and Cultural Organization (UNESCO) Man and the Biosphere program and named as part of the Central California Coast Biosphere Reserve.


Bruce Farnsworth

The cultural history of Point Reyes spans many lives and ways of living with the land. The Coast Miwok people are the first known residents of this peninsula. Archeologists have identified over 100 village sites in the Seashore and cultural traditions are still celebrated in the Park annually. Overlapping the Coast Miwok were Mexican land grantees, lighthouse keepers, and lifesaving station crews. To this day, agricultural operations that were built near the turn of the twentieth century continue within the Seashore's pastoral zone.


NPS Collection

Educational Opportunities at

Point Reyes National Seashore

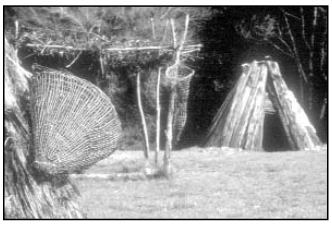
Point Reyes National Seashore provides an outdoor classroom and learning laboratory for the study of geological and ecological processes and changing land-use values in which a greater understanding of and caring for public lands can be fostered.

Ranger-led Curriculum-based Education Programs

Reservations for Ranger-led programs are requested in writing and assigned on a first-come, first-served basis. Visit ***www.nps.gov/pore*** for the reservation form and calendar.


NPS Collection

K-2 Students explore the natural resources of the Seashore with Park Rangers in the Bear Valley area or in their classroom.


NPS Collection

3-4 Students immerse themselves in the Coast Miwok culture by completing a comprehensive curriculum and visiting the Coast Miwok cultural exhibit, Kule Loklo.


NPS Collection

4 Students revisit the days of early lighthouse keepers while operating the original Point Reyes Lighthouse clockwork with Park Rangers.


NPS Collection

5 Students study the oceanic influences on the Point Reyes Peninsula by completing a classroom curriculum and viewing gray whales and elephant seals with Park Rangers.

6-8 Students participate in Ranger-led stewardship activities such as habitat restoration, water quality monitoring, and beach cleanups.

Ranger-led Training Programs


NPS Collection

9-12 Students become DOCENTS to assist middle school teachers with classroom teaching and use of scientific research tools on Seashore field trips (service learning credits earned).

Students become RESEARCH ASSISTANTS at the Pacific Coast Learning Center by participating in the inventorying and monitoring of Seashore resources.


NPS Collection

Teachers Teacher workshops are offered throughout the year for existing Park curricula and for field trip planning. Visit the Seashore's website at ***www.nps.gov/pore*** for a calendar of workshops.

Classroom and Field Trip Curriculum

Based on the National and State Science and Social Science Standards

3-4

Teacher packets are available for field trips to the recreated Coast Miwok village, Kule Loklo, located near the Bear Valley Visitor Center.

The "Creating Coastal Stewardship through Science" middle school curricula are available to teachers who attend a one-day workshop at Point Reyes or a teacher in-service training.

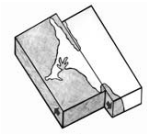
6-8

Completion of the ***Identifying Resident Birds*** Curriculum, as a companion to a birdwatching field trip, will enable students to observe and identify different bird species, their habitats and their behaviors. A visit to Point Reyes Bird Observatory will also enable students to observe bird banding and netting and to understand the most common threats to bird survival.

Completion of the ***Monitoring Creek Health*** Curriculum, as a companion to a Ranger-led creek program, will enable students to observe and understand the complexity and sensitivity of creek habitats and their role in protecting them.

Completion of the ***Discovering Northern Elephant Seals*** Curriculum, as a companion to an elephant seal viewing field trip, will enable students to observe and understand the amazing adaptations and behaviors of Northern elephant seals.

Completion of the ***Defining Habitats*** Curriculum, as a companion to a Park field trip, will enable students to observe and understand the complex land and ocean habitats of the Point Reyes Peninsula and their roles in habitat protection.



Completion of the ***Uncovering the San Andreas Fault*** Curriculum, as a companion to a geology field trip, will enable students to observe and understand the existence of the San Andreas Fault and the implications that it has for area residents.

Completion of the ***Investigating Tule Elk*** Curriculum, as a companion to an elk viewing field trip, will enable students to observe and understand their behaviors and the issues that surround their management.

Completion of the ***Observing Pacific Gray Whales*** Curriculum, as a companion to a whale watching field trip, will enable students to observe and understand gray whale adaptions and behaviors, and the factors that influence their survival.

Educational Facilities

The **Historic Lifeboat Station** is available to educational groups for overnight use. Nightly fees are charged. Group size must be under 25 (including chaperones). Reservations are made on a first-come, first-served basis by completing the boathouse form on our website at ***www.nps.gov/pore.***

The **Clem Miller Environmental Education Center** is an overnight facility available by lottery to school groups visiting for multiple-night stays September through mid-June. The facility is used for summer camps during the summer months. Fees are charged. For more information, contact Point Reyes National Seashore Association at (415) 663-1200 or ***www.ptreyes.org***

The **Pacific Coast Learning Center** is a day-use facility located on Highway 1. This facility is used by researchers and students to study the natural and cultural resources of the Seashore.

The **Bear Valley Visitor Center** is a day-use facility open to school groups Monday through Friday from 9 A.M. to 5 P.M. Exhibits on natural and cultural resources are found here. Books, brochures, and other educational materials are available.

The **Ken Patrick Visitor Center** is located on Drakes Beach, approximately 30 minutes from the Bear Valley Visitor Center. This facility is open year-round on weekends and holidays from 10 A.M. until 5 P.M. Ranger-led elephant seal programs meet at this Visitor Center. Exhibits and a 150-gallon saltwater tank are located here. Books, brochures, and other educational materials are available.

The **Lighthouse Visitor Center** is located on the outermost tip of the Peninsula, approximately 45 minutes from the Bear Valley Visitor Center. This facility is open Thursday through Monday from 10 A.M. until 4:30 P.M. (closed Tuesdays and Wednesdays). Ranger-led whale programs and lighthouse tours meet at this Visitor Center. Exhibits on maritime history and whale biology are located here. Books, brochures, and other educational materials are available.

The **Lighthouse** is located below the Lighthouse Visitor Center at the bottom of a 308-step staircase. The lens room is usually open from 2:30 P.M. until 4 P.M. Thursday through Monday or as weather and staffing permit. High winds always close the lens room. Space in the lens room is limited so reservations are required for groups. Call (415) 669-1534 to confirm existing weather conditions.

Group Camping/Overnight Opportunities

* This listing is provided for your convenience and does not constitute a recommendation or endorsement of any of these facilities.

All overnight camping in **Point Reyes National Seashore** requires a permit and advance reservations. Group sites are very limited and in high demand. Sky, Coast, and Wildcat Camps are all backcountry campgrounds that require hiking to access them. A fee is charged. For more information, visit the Seashore's website at ***www.nps.gov/pore.***

The **Point Reyes Hostel** offers a domitory-style group cabin with a fully equipped kitchen and showers. For additional information and reservations, call (415) 663-8811 during office hours 7:30 to 9:30 A.M. and 4:30 to 9:30 P.M.

Samuel P. Taylor State Park, located 6 miles east of the Seashore on Sir Francis Drake Boulevard, offers campsites for groups. A fee is charged. Reservations are highly recommended. For more information, visit the reservations website at ***www.reserveamerica.com.***

Olema Ranch Campground is located half a mile from Seashore headquarters on Highway 1. It is privately owned. Several large group sites are available. Fees are charged. For more information, call (415) 663-8001.

The **Marconi Center** is located 8 miles north of Seashore headquarters on Highway 1. This facility is operated by California State Parks. Lodging, conference rooms, and catered meals are provided for a fee. For more information, call 1 (800) 970-6644 or visit the website at ***www.marconiconfctr.org.***

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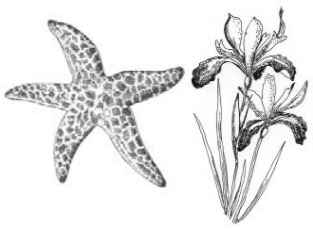
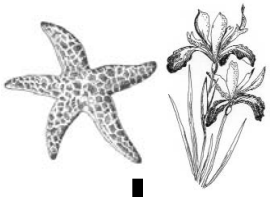


Defining Habitats

Teacher Preparation

Defining Habitats



Point Reyes National Seashore contains an amazing variety of ocean and land habitats. From the mixed woodlands of the Olema Valley to the sandy beaches along the ocean's edge, these habitats support a seemingly endless diversity of life. As your students experience these habitats they will have an opportunity to discover the value of this seashore in their lives.

Considerations

When: May be used year-round. The tidepool habitat is best visited in the winter during a midday minus tide.

Where:

- **Bear Valley Trail** for Douglas fir woodland and riparian habitat
- **Coast Trail** for coastal scrub and riparian habitat (and potentially sandy beach)
- **Limantour Beach** for coastal scrub, sandy beach and estuary habitats
- **Bayview Trail** to Muddy Hollow for bishop pine forest, coastal scrub, and riparian habitats
- **Duxbury Reef** or **Sculptured Beach** for tidepooling

How:


This symbol marks an activity that should only be used for land habitat studies.


This symbol marks an activity that should only be used for ocean habitat studies.


When combined, this symbol marks an activity that may be used for both land and ocean habitat studies.

This unit may be used independently of all other units. If you want to use an additional unit during your visit, we suggest using "Uncovering the San Andreas Fault", "Identifying Resident Birds", or "Monitoring Creek Health".

Teacher Preparation

Weather: The chart below lists average climate expectations based on previous year's data. The weather is subject to change quickly and can vary dramatically from different locations within the Seashore on the same day.

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Temperature (Fahrenheit)												
Normal Daily Maximum	53	55	55	57	60	62	64	64	65	62	58	54
Normal Daily Minimum	41	42	42	43	47	50	51	52	51	48	45	42
Extreme High	78	85	80	92	94	99	96	96	103	96	81	79
Extreme Low	21	26	29	32	32	39	39	42	39	32	29	18
Precipitation (inches)												
Normal	12.0	9.0	8.0	4.0	3.0	1.0	0.3	0.8	2.0	4.0	9.0	12.0
Maximum	20.0	16.0	15.0	11.5	8.0	4.0	2.5	6.0	7.0	13.0	18.0	19.0

Seasonal Events: Consult the chart below to assess which months may be best for a class visit to Point Reyes National Seashore.

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Gray Whale Migration	✔		✔	✔								
Elephant Seal Breeding	✔	✔	✔									
Bird Migration			✔	✔	✔				✔	✔	✔	✔
Coho Spawning	✔											✔
Steelhead Trout Spawning		✔										✔
Tule Elk Rut Season							✔	✔	✔			
Peak Flower Blooms			✔	✔	✔							
Tidepooling	✔	✔	✔									
Geology	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
Ocean and Land Habitats	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
Resident Birds	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔

Chaperone Preparedness and Assistance

The success of your field trip will depend on your ability to actively prepare and involve your parent chaperones in the field trip activities. Without adult guidance, many of the students will not complete their field journals. It is essential that your field trip have as much structure as your classroom lessons.

- Assign each of your parents to a small group of students.
- Inform each parent of their responsibilities for assisting their students with field observations and with journal questions.
- Provide each chaperone with their own copy of the student journals and encourage them to complete it with the students.

Suggested Lesson Plan

PRE-VISIT		Time Needed: 5 hours
Activity #1	How Do We Identify the Plants and Animals of Point Reyes National Seashore? *Students become familiar with observation techniques for wildlife and plant species.*	1 .5 hrs
Activity #2	What Flora and Fauna Can We Expect to See On Our Field Trip? *Students assume the roles of botanists and biologists to gain familiarity with field guides and other research sources.*	2 hours
Activity #3	How Can We Prepare for Our Visit to Point Reyes National Seashore? *Students prepare for field trip by reviewing expectations and creating field journals.*	1 hours
Activity #4	Safety and Stewardship Challenge *Proper behaviors around National Park resources are examined in a game format.*	30 min
Activity #5	How Do I Use Binoculars?	varies
ON-SITE		Time Needed: 3 hours
Field Journal	How Can We Understand the Habitats of Point Reyes National Seashore? *Students complete their field journals by using the Bear Valley Visitor Center exhibits and field observations.*	3 hours
Optional Onsite	What Can We Do to Restore Habitats Within Our Ecosystem? *Teachers should consider a Habitat Restoration or Beach Clean Up stewardship activity to follow-up their field visit.*	varies
POST-VISIT		Time Needed: 2 hours
Activity #1	What Can We Learn From Our Field Journals? *Students compile data from their field journals to draw conclusions between what they have previously learned in class and what they experienced in the field.*	2 hours
Activity #2	How Can I Choose and Complete the Best Stewardship Project for me? *Students develop action plans to complete a project that will benefit habitats and their environment.*	time varies

Field Trip Logistics

Students need:	*Teachers need:*	*Chaperones need:*
❒ rain gear	❒ rain gear	❒ rain gear
❒ warm, layered clothes	❒ warm, layered clothes	❒ warm, layered clothes
❒ gloves and hat	❒ gloves and hat	❒ gloves and hat
❒ sunscreen and sunglasses	❒ sunscreen and sunglasses	❒ sunscreen and sunglasses
❒ bag lunch with drink	❒ bag lunch with drink	❒ bag lunch with drink
❒ water	❒ water	❒ water
❒ waterproof boots or tennis shoes	❒ waterproof boots or tennis shoes	❒ waterproof boots or tennis shoes
❒ clipboard with field journal and pencil	❒ map with directions	❒ map with directions
❒ permission slip	❒ pencil sharpeners and extra pencils	
	❒ teacher backpack and field trip kits from Bear Valley Visitor Center	
	❒ first aid kit	
Optional:		
❒ small backpack	❒ small backpack	❒ small backpack
❒ binoculars	❒ binoculars	❒ binoculars
	❒ camcorder/camera	❒ camcorder/camera

Other Things to Remember:

- Have students bring a bag lunch since you will be visiting during lunch time.
- If you have a student with accessibility concerns, please call the Park for suggestions.
- Students need warm, waterproof clothing most of the year. Sunscreen is needed on most days. Students should always be prepared for all types of weather.
- Have the students wear long pants and closed-toe shoes, preferably tennis shoes.
- Binoculars will assist the students in viewing the wildlife. These may be checked out from the Bear Valley Visitor Center. If you plan to use this equipment, it is essential that you train the students to use binoculars before their visit. See the enclosed binocular activity.

Bear Valley Trail: Douglas fir woodland/riparian habitat

- Bathrooms are located in the Earthquake Trail parking lot and in the Bear Valley Visitor Center. Trash cans for lunch waste are also located here.
- Travel time from Point Reyes Station to the Bear Valley Visitor Center is about 15 minutes. Most groups visit the Bear Valley Area between 10 A.M. and 1 P.M. If you plan to visit during this time, have students bring a bag lunch. A picnic area with tables and trash cans is located across from the Bear Valley Visitor Center. Following lunch, have them check the area for trash.
- The beginning portion of the Bear Valley Trail is accessible to wheelchairs.

Coast Trail: coastal scrub/riparian habitat/sandy beach

- Coast Trail is NOT directly accessible to buses. The bus parking lot for the Education Center (located on the Limantour Beach road before the Ed Center turnoff) may be used for access. After parking in this lot, students will walk to Coast Trail using the trail to the Education Center (approximately 10 minutes). We suggest that you plan carpools for this hike to avoid the logistics of parking the bus.
- Bathrooms are not available near Coast Trail unless you are staying overnight at the Clem Miller Education Center or the Hostel. The closest bathrooms are located in the Limantour Beach parking lot or at the Bear Valley Visitor Center.
- Travel time from Point Reyes Station to Coast Trail is about 20 minutes. Most groups use this trail between 10 A.M. and 1 P.M. If you plan to visit during this time, have students bring a bag lunch. No picnic area is located on this trail. However, Limantour Beach has a large parking lot (or area) and easy access to the beach for lunch. Following lunch, have them check the area for trash.
- Drinking water is not available on Coast Trail. Have the students bring their own drinking water.
- Most of Coast Trail is accessible to wheelchairs but the trail leading down from the bus parking lot is not. Parking for private vehicles is available near the trail.

Limantour Beach: coastal scrub/estuary/sandy beach habitat

- Bathrooms (no running water) are available near the Limantour Beach main parking lot.
- Travel time from Point Reyes Station to Limantour Beach is about 25 minutes. Most groups use this beach between 10 A.M. and 1 P.M. If you plan to visit during this time, have students bring a bag lunch. No picnic area is located on the beach but there are many open areas in which to sit. Following lunch, have them check the area for trash.
- Limantour Beach is accessible to wheelchairs via a paved trail to the dune area. Special wheelchairs are needed to travel on the sand. A special beach wheelchair is available for checkout (first-come, first-served) from the Point Reyes National Seashore Association at (415) 663-1200.

Bayview Trail to Muddy Hollow: Bishop pine forest/coastal scrub/ riparian habitat

- Bayview trailhead is directly accessible to buses. A combination of trails may be hiked to create a loop or students may hike down and up the Bayview Trail. For a one-way hike from Bayview to Muddy Hollow, we recommend carpooling so that all drivers may drop the students at Bayview, then meet the group at Muddy Hollow. The Muddy Hollow road is not accessible to buses. Consult a Park trail map for more hiking information.
- Bathrooms are not available near Bayview trailhead. The closest bathrooms are located in the Limantour Beach parking lot or at the Bear Valley Visitor Center.
- Travel time from the Bear Valley Visitor Center to Bayview trailhead is about 15 minutes. Most groups use this trail between 10 A.M. and 1 P.M. If you plan to visit during this time, have students bring a bag lunch. No picnic area is located on this trail. However, the Bayview trailhead has a large parking lot. Following lunch, have them check the area for trash.
- Drinking water is not available at the Bayview trailhead. Have the students bring their own drinking water.
- Bayview trail is not accessible to wheelchairs.

Duxbury Reef or Sculptured Beach: tidepool habitat

Tide pool creatures are extremely sensitive to humans. Trampling and careless handling kill thousands of tidepool creatures every year. Please respect this resource.

- The easiest tidepools to visit are located at Duxbury Reef, south on Highway 1 outside of Point Reyes National Seashore. Driving time from Bear Valley Visitor Center is approximately 30 minutes.
- In Point Reyes National Seashore, Sculptured Beach may be accessed using Laguna or Coast Trails, or by walking along Limantour Beach (minus tide only). Due to the isolated location, hiking and tidepooling at Sculptured Beach takes 4 to 6 hours. This is only recommended for groups staying overnight at the Clem Miller Education Center, Youth Hostel, or at Coast Camp.
- Read the tide chart for the day you plan to visit. Tidepools are only visible during minus tides and are UNSAFE during moderate or high tides.
- Pit toilets (no running water) are located in the Duxbury Reef and Limantour Beach parking lots. Trash cans for lunch waste are also located here.
- Tidepooling is best during the winter due to the midday minus tides. This is the rainy and windy season. Students need warm, waterproof clothing and high, waterproof boots. Sunscreen is needed on most days.
- Ticks are abundant along the trails accessing Sculptured Beach. Staying out of scrub and on designated trails will minimize contact with ticks. See attached brochure for more information.
- Travel time from Point Reyes Station to the Limantour Beach parking lot is 25 minutes.
- Sculptured Beach is not accessible to wheelchairs, and people with a fear of heights may have difficulty descending the stairs leading to Sculptured Beach.

Evaluation Process

We need your help! Since this guide was designed for your use, only your feedback will make it better. Following the unit overview is a preaddressed evaluation form. Please complete, fold in thirds, affix postage, and drop in the mailbox. In addition to the evaluation forms, we encourage other types of feedback. Please send any of the following items from your students:

1. Videotape or photos of Park field trip
2. Completed student journals
3. Any completed stewardship activities, including posters or newsletters
4. A class portfolio illustrating lesson activities
5. Any completed classroom projects or photographs of projects
6. Other items illustrating student feedback

Please indicate if these items need to be returned. We will use them to create a project library, highlight classroom efforts on our website and in Park publications, and complete evaluations of student outcomes.

Send to: National Park Service
Point Reyes National Seashore
Division of Interpretation
attn: Education Specialist
Point Reyes Station, CA 94956

Reservations

Please use the reservation form provided in this unit to contact the Seashore about your plans to do a self-guided, curriculum-based field trip to Point Reyes National Seashore.

Habitat Backpack Contents

Habitat backpacks are available for check out at the Bear Valley Visitor Center. Clem Miller Education Center users may check them out at the Ed Center. These are available on a first-come, first-serve basis.

15 pairs of binoculars (for student use)
Various field guides (birds, plants, mammals)
Species identification cards
First aid kit
Magnification lenses
Thermometers

California Science Standard Links

	"Defining Habitats" Unit							
	Pre-Visit					On-Site	Post-Visit	
	#1	#2	#3	#4	#5	Field Journal	#1	#2
Sixth Grade								
1								
2						a,b,c,d	a,b, c,d	
3								
4						e	e	
5	a,b, c,d	a,b, c,d,e				a,b,c,e	a,b, c,d,e	
6								
7	b	b,d	b		b	b,c,e,f,h	a,b, c,d, e,f	
Seventh Grade								
1								
2								
3								
4								
5						a		
6					b,d			
7	a	a,b, e	a		a	a,d	a,b, c,d,e	
Eighth Grade								
1								
2								
3								
4								
5								
6								
7								
8								
9			a			a,b	a,b	

Correlations to "A Child's Place in the Environment"
California's State Approved Environmental Education Curriculum

	"Defining Habitats" Unit							
	PRE-VISIT					ON-SITE	POST-VISIT	
	#1	#2	#3	#4	#5	Field Journal	#1	#2
A Child's Place in the Environment: Grade 6 Lessons								
What Are Some Components of an Ecosystem?		✔				✔	✔	✔
What Role Does Diversity Play in an Ecosystem?	✔	✔				✔	✔	✔
How Does the Sun's Energy Flow Through an Ecosystem?							✔	
What Interrelationships and Niches Can Be Identified in an Ecosystem?		✔				✔	✔	
What Cycles Exist in an Ecosystem and How Do They Sustain an Ecosystem?						✔		
What Examples of Ecological Principles Can Be Observed in an Ecosystem?		✔				✔	✔	✔
What Are the Components and Relationships of Human Communities and How Do They Compare to Ecosystems?		✔					✔	
What Are Some Limiting Factors in Human Communities and in Ecosystems?		✔						✔
How Do Energy Sources Used in Human Communities Compare to Those Used in Ecosystems?								
How Can Organic Solid Waste in Human Communities Be Composted?								
How is Land Used by Our Community and How Are Land-Use Decisions Made?								
How Can the Disposal of Solid Waste Affect the Quality of the Environment?								
How Does the Motor Vehicle Transportation System Affect the Environment?								
How Do Human Beings Affect Watersheds?					✔		✔	✔
What Human Actions Enhance, Protect, and Sustain the Quality of the Environment?			✔		✔			✔
What Have Communities Done to Become More Sustainable?								
What Projects Can Students Implement to Make Their Classroom and School or Community More Sustainable?								✔

Acknowledgments

This unit was written by area teachers, Park Rangers, scientists, and area naturalists. Special thanks to the following people:

Workshop Participants

Jules Evens, Naturalist
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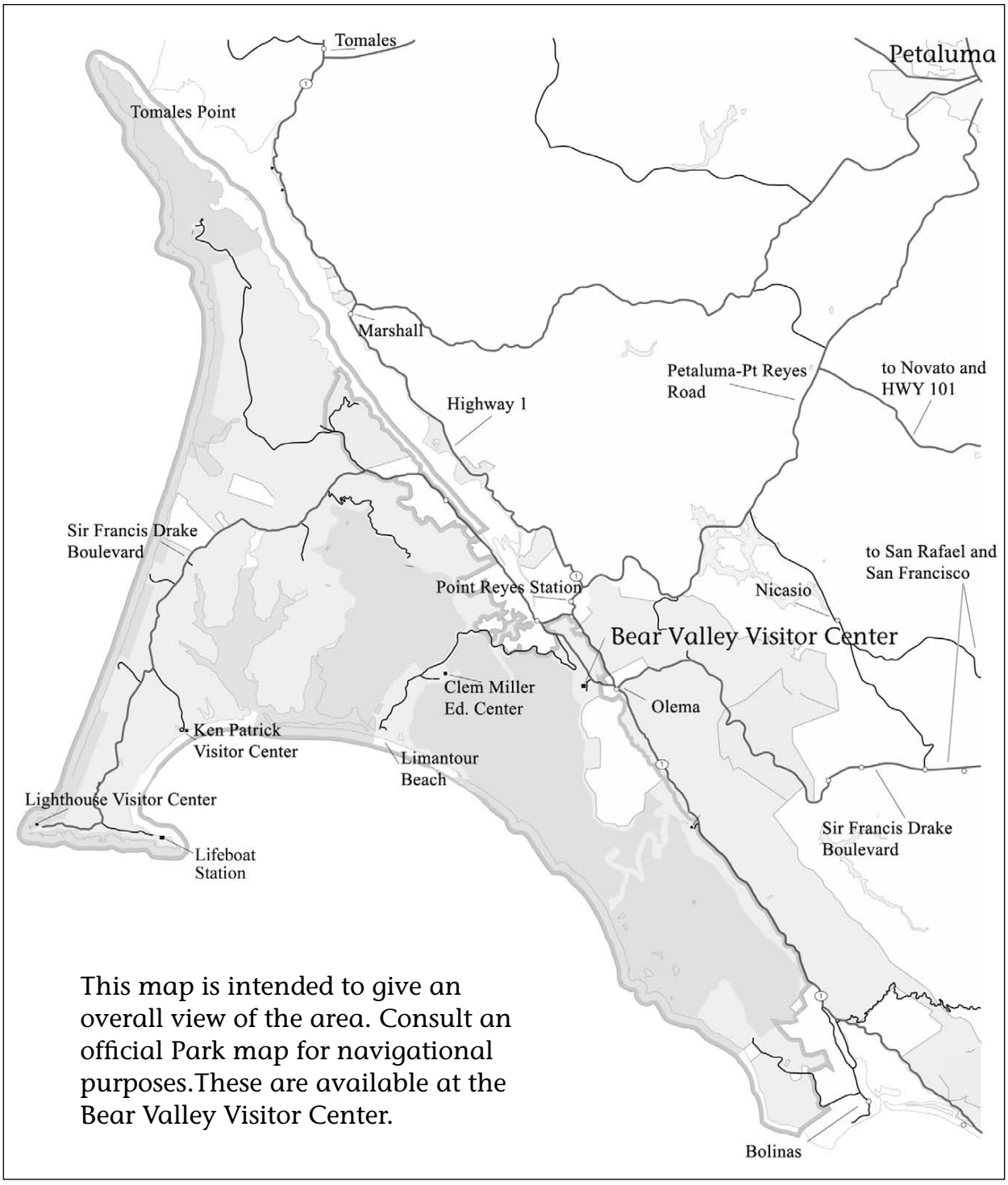
Point Reyes National Seashore

Attachment

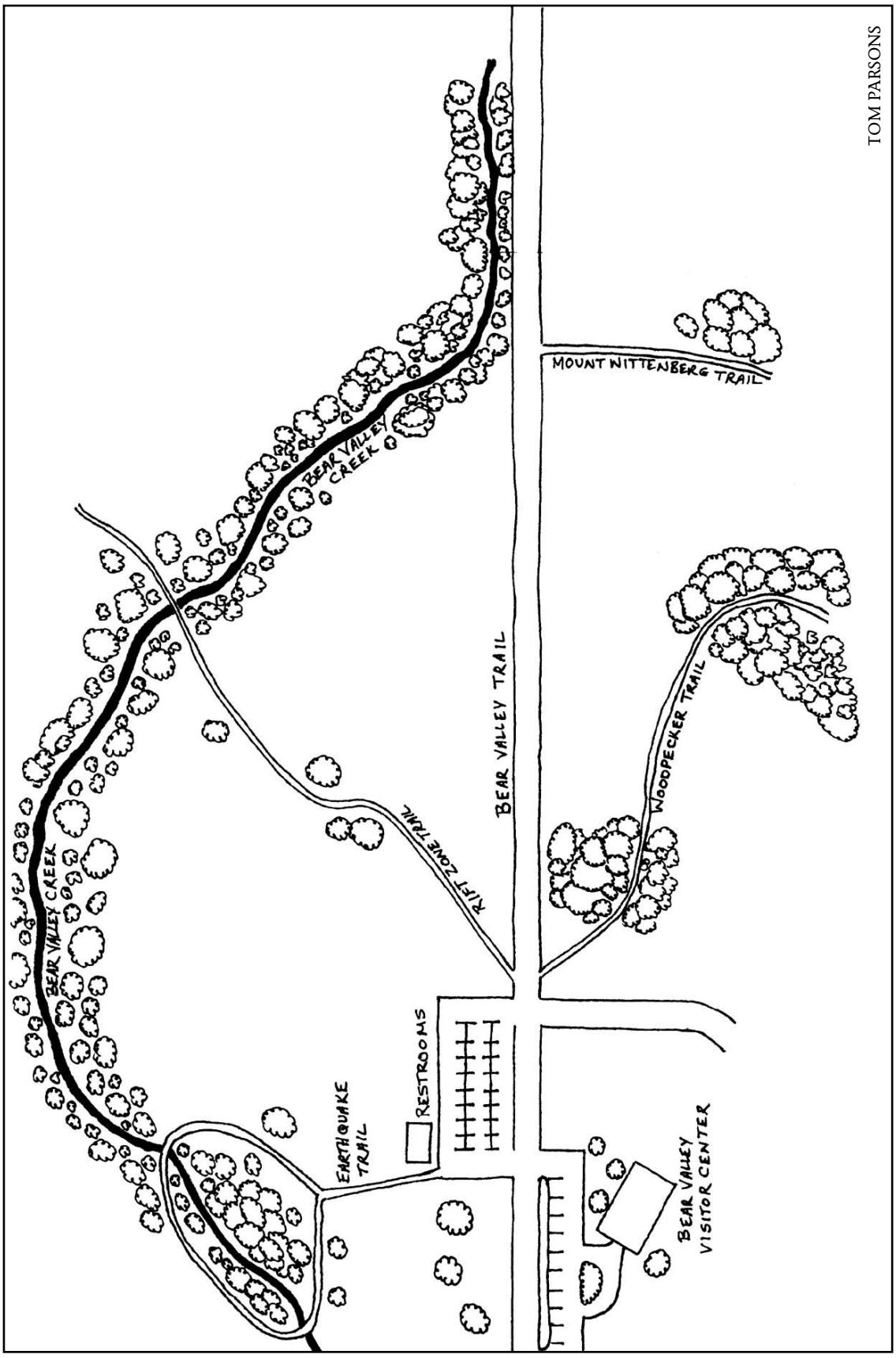


Approximate Driving Times/Distances

Petaluma to Bear Valley VC	40 min./19 miles
Novato to Bear Valley VC	40 min./19 miles
San Anselmo to Bear Valley VC	30 min./20 miles
Bear Valley VC to Limantour Beach	20 min./9 miles
Bear Valley VC to Tomales Point	30 min./19 miles
Bear Valley VC to Ken Patrick VC	30 min./15 miles
Bear Valley VC to Lighthouse VC	45 min./22 miles

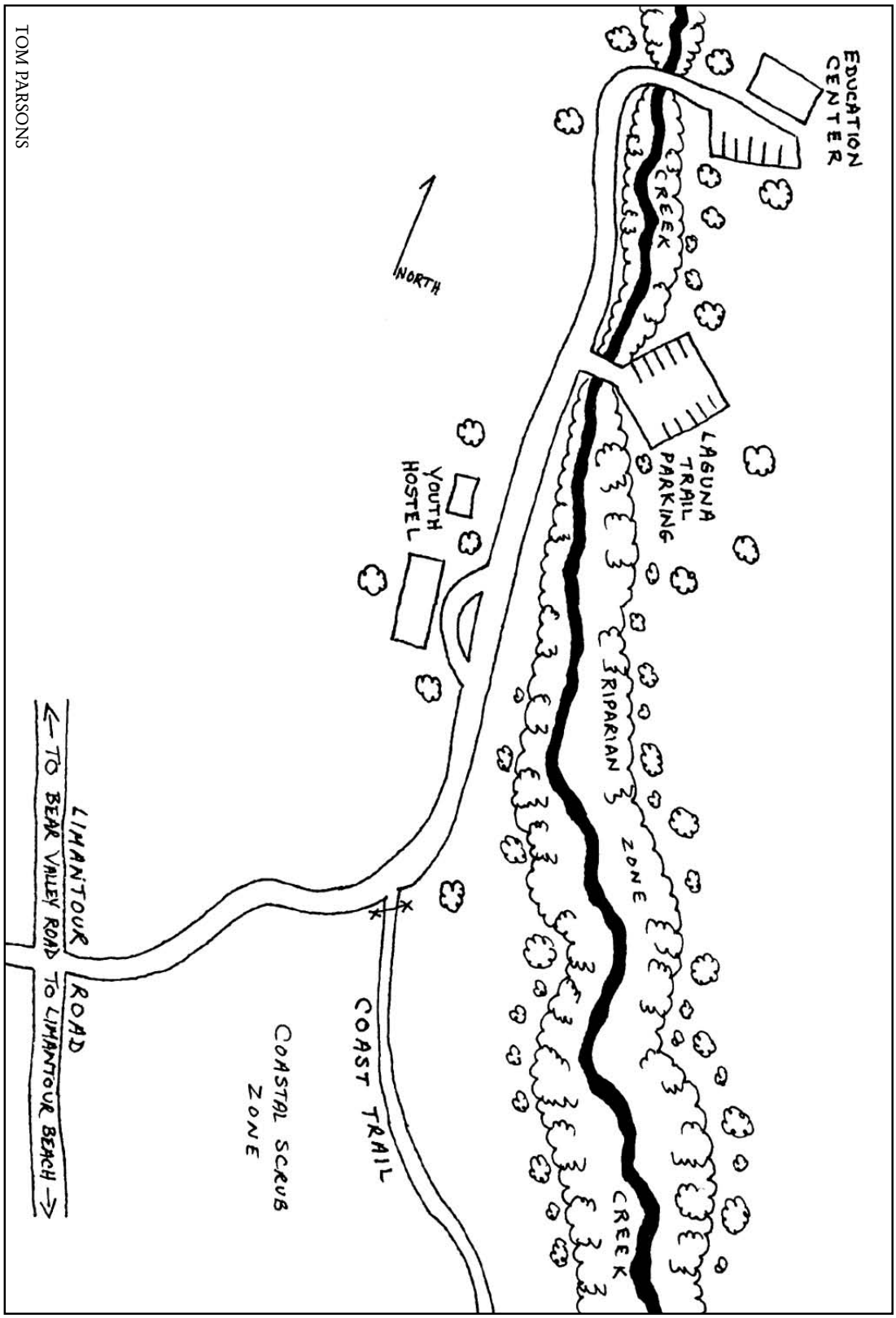
Attachment

Bear Valley Trail Site Map



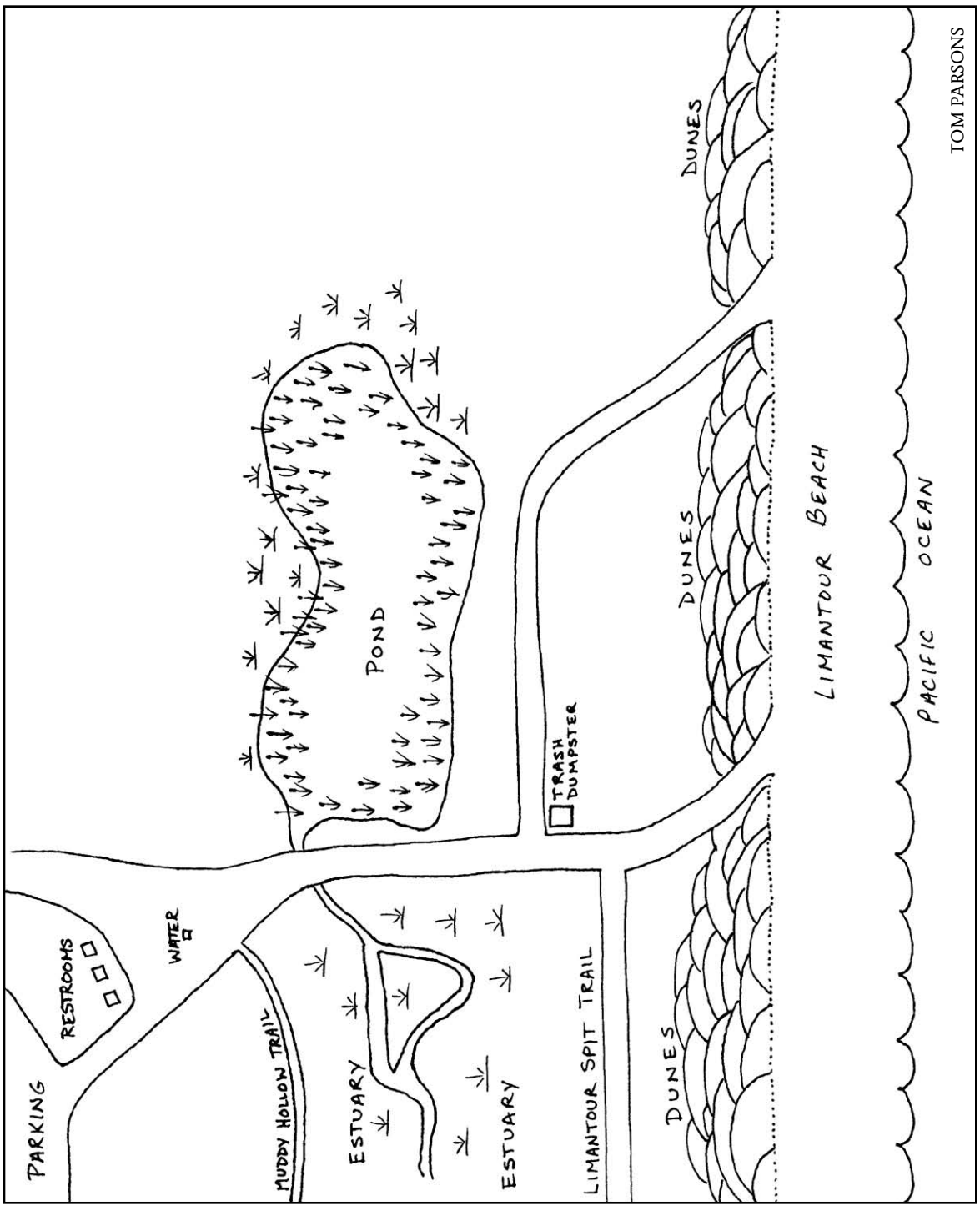
Coast Trail/Ed Center Site Map

Attachment



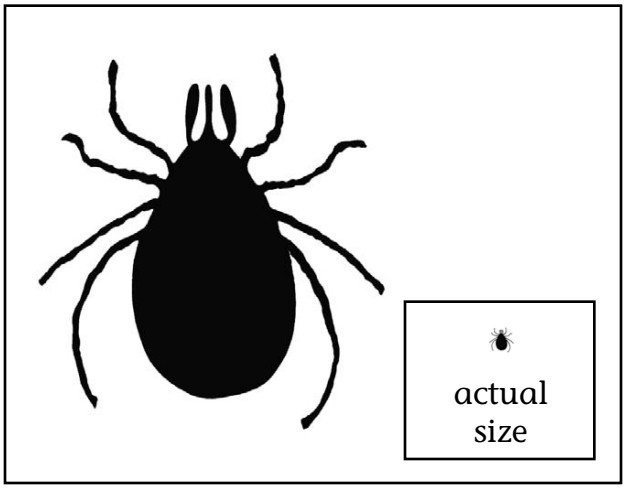
Attachment

Limantour Beach Site Map



Lyme Disease, Stinging Nettle, and Poison Oak

Lyme disease is an illness caused by bacteria transmitted to people by tick bites. Not all ticks carry the disease. Field studies in Marin County show that 1–2% of the western black-legged ticks carry Lyme disease. Since there are several other species of ticks in Marin, the odds of a tick bite producing Lyme disease are less than 1 in 100. Even so, Lyme disease can be severe; it is important to understand the prevention and symptoms.



Symptoms:

arthritis and joint pain
lethargy
heart problems
pain/limping
fever
kidney problems
depression
bull's-eye rash (50% of victims)

Tick species in California include:

Western black-legged tick and Pacific coast tick (West Coast)
Lone star tick and American dog tick (throughout U.S.)

How to avoid tick bites:

- Wear light-colored, long-sleeved clothes so you can more easily see the ticks.
- Tuck shirt into pants and pants into socks to keep ticks away from your skin.
- Stay on trails.
- Apply an insect repellent, labeled for ticks, to shoes, socks, and pants.
- Check yourself completely after a hike. Closely check any skin irritation. Ticks anesthetize the skin before biting so you'll seldom feel the original bite.

What to do if bitten:

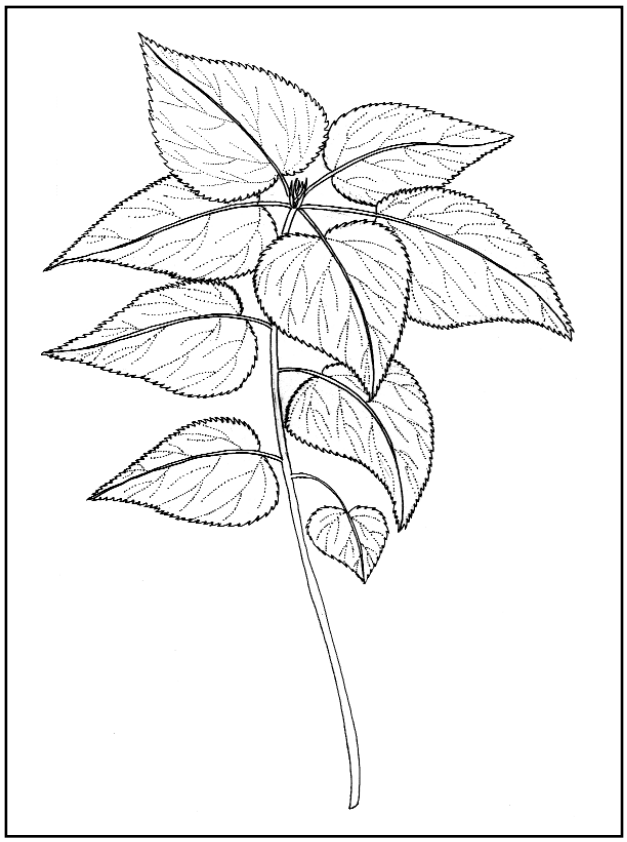
- Use tweezers to grasp tick at point of attachment, as close to skin as possible. Gently pull tick straight out.
- Save tick, notify your doctor.
- Don't panic—ticks need to be embedded for 24–48 hours to transmit bacteria. The ticks that transmit Lyme disease are usually in a developmental phase in which they are smaller than the head of a pin.

References:

Ticks and Lyme Disease in the National Parks (brochure)
Lyme Disease Foundation at ***www.lyme.org***

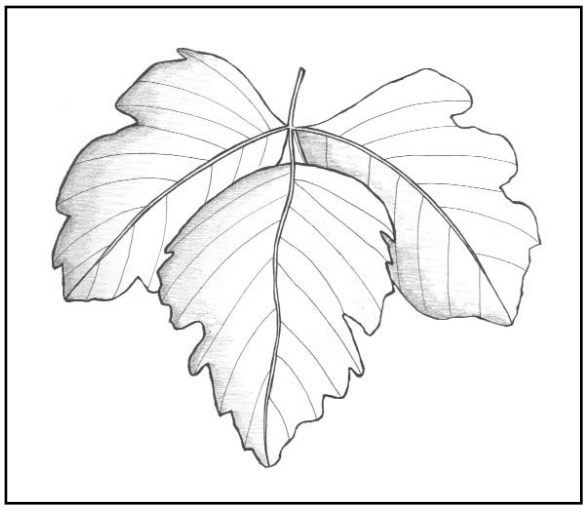
Lyme Disease, Stinging Nettle, and Poison Oak

(continued)



Stinging nettle is native to Europe, but grows at Point Reyes National Seashore. It can cause a painful rash that stings for up to twelve hours after brushing up against the plant. A topical analgesic (used to treat poison ivy or bug bites) can be applied to help alleviate the sting. Study the picture and have someone point out the plant in the Seashore to aid in its identification.

Poison oak usually causes an itchy rash if you are sensitive to it. You can get a rash by touching the plant, its leaves or roots. You can also contract poison oak by petting your dog (if the oils are on its coat) or by touching clothing that has touched poison oak. Rashes may occur several days after the initial contact with the plant. Severe rashes may affect the lungs. If you have difficulty breathing, call 911 or go to the nearest emergency room immediately. Preventive topical ointments are available to help avoid reactions to poison oak. Learn to recognize the compound leaves with a shiny appearance.



Creating Coastal Stewardship through Science

Reservation Form

If you are planning a trip to Point Reyes National Seashore to use this curriculum, please notify the Park to avoid conflicts with other groups and to be notified about any unusual closures. Mail this form at least two weeks in advance (fold in thirds and affix postage) or call (415) 464-5139 to leave a message.

Teacher Name: _____

School Name: _____

School Address: _____

City/State: _____ Zip Code: _____

School Phone: _____ School Fax: _____

Email Address: _____

Grade: _____ Class Size: _____

Home Phone: _____

Field Trip Options

Monitoring Creek Health
Observing Pacific Gray Whales
Discovering Northern Elephant Seals
Defining Habitats
Investigating Tule Elk
Uncovering the San Andreas Fault
Identifying Resident Birds

Field Trip Preferences

Field Trip Topic	Dates (list three in order of preference)	Time
1. _____	_____	_____
	_____	_____
	_____	_____
2. _____	_____	_____
	_____	_____
	_____	_____

Comments

_____ Confirmation Letter
_____ Materials Sent

National Park Service
Point Reyes National Seashore
Division of Interpretation
attn: Education Program Coordinator
Point Reyes Station, California 94956

Creating
COASTAL
STEWARDSHIP
through Science

Creating Coastal Stewardship through Science

Evaluation Form

Please help us develop and improve our programs by taking a few minutes to complete this form. This evaluation form is preaddressed, but needs to be folded in thirds and provided with postage. If you prefer, email comments to: ***PORE_Education@nps.gov***

Name: _____ School Name: _____

School Address: _____

City/State/Zip Code: _____

School Phone: _____ School Fax: _____

Email Address: _____

Class Size/Grade: _____

Date of Visit: _____ Program/Location: _____

Getting Your Visit Set Up

Do you have any suggestions to make logistics easier? (maps, directions, reserving programs)

Curriculum Materials

Which lessons were the most effective?

Relevance of content to my students and curriculum:

Grade appropriateness?

Program Assessment

How does this program fit into California/National Standards and your personal education program?

Strengths/weaknesses of program?

Best part of experience?

What is the level of support at your school for this program?

What could the National Park Service do to improve your education program?

Overall, how would you respond if a colleague asked about this program?

Highly recommended Recommended Recommended with some qualifications
Not recommended

National Park Service
Point Reyes National Seashore
Division of Interpretation
attn: Education Specialist
Point Reyes Station, California 94956

Creating
COASTAL
STEWARDSHIP
through Science

Land Definitions

Vocabulary

Adaptations	an organism's adjustment to environmental conditions that makes it more fit for survival
Aggregation	a crowd or dense cluster, usually used to describe groups of animals
Amphipod	any of numerous small, flat-bodied crustaceans of the group Amphipoda, including the beach fleas, sand hoppers, etc.
Animal sign	evidence of an animal's presence including scat, rubbings, tracks and trails
Annual precipitation	the amount of rain, snow, hail, etc., that falls at a given place within a one-year period, usually expressed in inches or centimeters of water
Anthrax	deadly bacteria that thrive in decaying cattle and sheep and usually causing the slow, agonizing death of any warm-blooded animal that gets infected
Array	a collection device to collect small mammals and amphibians
Artifact	an item of historical or archeological significance
Bacteria	plural of bacterium, any of a class of single-celled organisms, spherical, spiral or rod-shaped, and appearing singly or in chains, various species of which are involved in fermentation, putrefaction, infectious diseases, or nitrogen fixation
Biological diversity or biodiversity	the number of species in a given habitat
Biologist	a scientist who studies the science of life or living matter in all its forms and phenomena, especially with reference to origin, growth, reproduction, structure, and behavior
Biotic community	an association of living organisms having mutual relationships among themselves and to their environment and thus functioning, at least to some degree, as an ecological unit
Bird	any warm-blooded vertebrate having a body covered with feathers, forelimbs modified into wings, scaly legs, a beak, no teeth and bearing its young in a hard-shelled egg
Botanist	a scientist who studies the science of plants, the branch of biology that deals with plant life
Bryozoan	an aquati invertebrate animal that forms colonies; also called moss animals

Vocabulary

Bud arrangement	a description derived from the way a plant grows; buds may be opposite each other, alternating, or coiled in a stem
Camouflage	an organism's physical appearance which blends into its environment
Carnivore	term commonly applied to any animal whose diet consists wholly or largely of animal matter
Carrying capacity	maximum population of a species that can be sustained in a habitat over the long term; usually refers to a particular species, but can be applied to more than one
Coastal scrub community	a plant and animal community characterized by low, drought-resistant shrubs and grasses
Commensal relationship	two or more kinds of organisms living close association, in which one may derive some benefit, but neither harms the other
Community	an association of living organisms having mutual relationships among themselves and to their environment and thus functioning, at least to some degree, as an ecological unit
Competition	members of the same or different species, living in the same environment, that have the same food or space requirements and that must compete for survival
Coniferous (plant)	retaining its leaves at the end of the growing season and usually remaining green through the winter
Consumer	an organism that relies on other plants or animals for food
Critical habitat	a specific area of land occupied by an endangered species
Crown	the overhead layers of vegetation, such as the canopy formed by the upper branches of trees in a forest
Cryptically colored	having a shell or skin that blends in with the environment and therefore protects an animal from being seen by a predator
Deciduous	having leaves that shed or fall off its leaves each year; the oposite of evergreen
Decomposers	nature's recycler; an organism, usually a bacterium or fungus, that breaks down the cells of dead plants and animals into simpler substances
Density	the number of organisms or items per unit area or volume
Detritus	organic material formed from decomposing organisms
Distribution	the arrangement or of a species in a given habitat

Disturbed area	an area where an ecosystem has been significantly altered
Diversity	the array of species present and their spatial distribution (i.e., biodiversity)
Dominant plant	the most abundant plant that one may see in a given habitat; for example, in the riparian thickets of Point Reyes National Seashore, the dominant plants are yellow willows and red alders
Ecological web	the interrelated web of plants, animals, fungi, and microbes
Ecosystem	a system formed by the interaction of dynamic and interrelating complex plant and animal communities of organisms with their non-living environment
Endangered species	any species in danger of extinction throughout all or a significant portion of its range
Environment	the air, water, minerals, organisms, and all other external factors surrounding and affecting a given organism at any time
Environmental factors	the combined influence of wind, rainfall, temperature, and exposure
Erosion	the loss of soil or rock through wind, rain, or wave action
Evergreen	always green; used to describe plants that do not lose their leaves or needles seasonally but, rather, stay green year-round; examples include Douglas fir, coastal live oak, California bay, and coyote bush; the opposite of "deciduous"
Exotic species	a plant or animal species introduced into an area where it does not occur naturally; nonnative species
Exposure	situation with regard to sunlight or wind; aspect: a southern exposure. something exposed, as to view; an exposed surface: exposures of rock
Fauna	all the animal species that may occur in an area
Fertile	productive
First order consumer	an organism, usually an animal, that feeds on plants or other animals
Flora	the plants of a particular region or period

Vocabulary

Food pyramid	a diagram that shows the relationship between producers and consumers in a food web
Food web	the multiple interrelationships between all species in an ecosystem or habitat
Forest litter	the nonliving materials which collect on the forest floor over time; this includes dead leaves, fallen plants or trees, dead animals, etc.
Freshwater marsh	a tract of low wetland, often treeless, dominated by herbaceous plants under the influence of fresh water
Geologic factors	soil and the rock from which it was derived
Germinate	the process where a dormant seed begins to grow, usually when seeds have contact with moisture
Girth	the measurement around something, also called the circumference
Habitat	the natural environment of an organism; place that is natural for the life and growth of an organism, "address"
Habitat type	a land or aquatic unit, consisting of an aggregation of habitats having equivalent structure, function, and responses to disturbance
Herb	nonwoody plants
Herbaceous	a plant whose stem is soft and green and shows little growth of wood; the term is used to distinguish such plants from woody plants
Heroic species	a species that captures our hearts and minds and focuses our attention on its survival for the freedom and wildness that it embodies
Human disturbance	damage to an area caused by human activity
Hypothesis	an educated guess or prediction of the outcome of an experiment
Indicator plant	a plant that indicates, by its presence in a given area, the existence of certain environmental conditions or habitats. For example, the coyote bush is an indicator of the coastal scrub habitat
Indigenous	originating in and characteristic of a particular region or country; native (as opposed to exotic) to the geographic location of a restoration site

Integrity	the wholeness, soundness, and health of a biotic community
International Biosphere	an area that has been recognized by the United Nations for its worldwide ecological significance
Invasive species	nonnative plants or animals that invade an area and threaten the health of native plants or animals by consuming all of the space and resources within the ecosystem
Inventory	a count or estimate of all the given species in a particular ecosystem
Invertebrate	pertaining to creatures without a backbone
Key characteristics	the most apparent qualities or attributes that help one distinguish specific parts of the natural world
Keystone species	a species that is critical to the survival of many others due to its role as a food source or a provider of habitat
Larva	the immature, wingless feeding stage of an insect that undergoes complete metamorphosis
Mammal	any vertebrate having the body more or less covered with hair, nourishing the young with milk from the mammary glands, and giving birth to live young
Microclimate	the climate of a small area within a region, the climate in this small area is different from the rest of the climate in the region
Microorganism	any organism too small to be viewed by the unaided eye, as bacteria, protozoa, and some fungi and algae
Migratory species	an animal that passes periodically from one region or climate to another, such as certain birds, fishes, and mammals
Monitoring	to keep track of species within an ecosystem for purposes of detecting long term trends and disturbances
Monocultures	a plant that solely grows in an area
Mutualistic relationship	two or more organisms living together in a mutually beneficial relationship
National Park System	areas of national significance, scenic beauty, or historic importance, preserved for the use and enjoyment of this and future generations

Vocabulary

National Park Service	people who manage the National Park System
National Seashore	an area of seacoast set aside and preserved for the public good
Niche	the ecological role, position, or function of an organism in a community of plants and animals, "profession"
Nitrogen fixing	nitrogenous waste is "fixed" and released into the water as nitrogen, a basic food source for microorganisms
Nitrogenous waste	a waste containing nitrogen
Nonnative species	a species which is foreign or exotic to an ecosystem
Organic debris	debris consisting of plant or animal material
Ornithologist	a scientist who specializes in and studies birds
Overstory or crown	the uppermost layer of trees in a forest, forming the canopy shading young trees, hardwoods, brush, and other plants growing beneath (i.e., understory)
Partnership	Point Reyes National Seashore has a partnership with the United States Geologic Service Biological Resources Division. With them, we have documented mountain lions, black-tailed weasels, bobcats, raptors, and other notable wildlife by using trail cameras
Perennial	a plant which has a life cycle lasting more than two years; generally, plants die back seasonally and regenerate from surviving roots or stems the following year
pH	a measure that indicates the relative acidity or alkalinity of a substance; the pH scale ranges from 0 (most acid) to 14 (most alkaline), with 7 being neutral
Pitch	a thick, sticky substance usually from conifers; also known as sap
Plant community	the plant populations existing in a shared habitat or environment
Population	organisms of the same species that occur in a particular place at a given time; a population may contain several discrete breeding groups or stocks
Predator	any organism that exists by preying upon or hunting other organisms

Prescribing controlled burns	resource managers can use controlled fires to reduce fuels found in forests and grasslands
Prey	an organism that is hunted by another species for food
Producer	a species that harnesses the sun's energy through photosynthesis to grow
Productive nutrients	nutrients which are rich and strongly help to support the inhabitants of an ecosystem
Raptor	a bird of prey (hawk, eagle, kestrel, falcon, osprey, etc.)
Rare or endangered species	a species of animal or plant listed that is rare, threatened, or endangered
Refuge	an area set aside to protect plants and animals
Regeneration	a new generation that forms from a past generation; after a forest fire, the forest will regenerate once the seedlings begin to grow
Reinvigorated	brought back to life, rejuvenated; when a forest fire sweeps through a forest, the forest can be reinvigorated
Reptile	a cold-blooded vertebrate that hatches from an egg, breathes air, and has scales or armor
Restoration	returning something to its original state
Ridge	a long, narrow elevation of land; a chain of hills or mountains
Riparian	relating to or living on the bank of a river or other body of water
Riparian habitat	a lush area along a river or other body of water
Riparian corridor	an area usually comprised of a creek or stream and its associated vegetation
Sapling	a young tree
Scat	excrement of an animal
Scavenger	an animal that eats dead or decaying matter
Second order consumer	an organism, usually an animal, that feeds on other animals
Seedling	a young tree that is generally less than 3 feet high

Vocabulary

Sensitive species	a species that is often the most vulnerable to changes in an ecosystem. They are usually good indicators of larger problems in the environment
Shorebird	birds that frequent seashores and feed on the sandy beaches and tidepools, waiting for the tides to move in and out, uncovering their food (fish, shellfish, etc.)
Shrub	a woody, perennial plant differing from a tree by its low stature and by generally producing several basal shoots instead of a single stem
Slope	the gradual rise or fall in elevation
Soil	the portion of the earth's surface consisting of disintegrated rock and humus
Species	the basic category of biological classification, composed of related individuals that resemble one another, are able to breed among themselves, but are not able to breed with members of another species
Stewardship	taking care of the environment by being involved; taking action and participating in clean ups, education programs, helping others become more aware, and making responsible choices
Substrate	the underlying geologic material of a soil
Survey	a detailed study of an area
System	a group of related natural objects and/or forces within a defined zone
Terrain	a tract of land, especially as considered with reference to its natural features
Thermal	a rising air current caused by heating from the underlying surface
Threatened species	any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range
Topography	the physical features of a place; hills, valleys, cliffs and plains
Topsoil	the fertile upper part of the soil
Track	the footprint or other mark left by an animal, person, or vehicle

Understory	the shrubs and plants growing beneath the main canopy of a forest, usually shade tolerant
Watershed	the region or area drained by a river, stream, etc.
Wildfire	out of control fire
Wildlife habitat	an area that provides a water supply and vegetative habitat and food for wildlife

Ocean Habitat Definitions

Vocabulary

Abyssal plain	the floor of the deeper ocean, offshore beyond the continental shelf
Adaptation	an organism's adjustment to environmental conditions; these modifications make it more fit for survival
Aggregation	crowded into a dense cluster; usually used to describe groups of animals
Algae	simple one-celled or many-celled plants, capable of photosynthesis, usually aquatic
Amphibian	a cold-blooded vertebrate that has gilled larvae, which becomes an air-breathing adult; such as a tadpole that becomes a frog
Amphipod	any of numerous small, flat-bodied crustaceans of the group Amphipoda, including the beach fleas, sand hoppers, etc.
Animal sign	the evidence of an animal's presence, including scat, rubbings, tracks, and trails
Annual precipitation	the amount of rain, snow, hail, etc., that falls at a given place within a year, usually expressed in inches or centimeters of water
Aquatic roots	roots that develop on stems above the area where they would normally grow, due to long periods of high-water levels
Bacteria	single-celled organisms, spherical, spiral, or rod-shaped, appearing singly or in chains, various species of which are involved in fermentation, putrefaction, infectious diseases, or nitrogen fixation
Bay	a recess in the shore, or an inlet of the sea or lake between two capes or headlands, not as large as a gulf, but larger than a cove
Benthos	the bottom of a body of water, for example, an ocean or a sea
Biological diversity or biodiversity	the number of species in a given habitat

Vocabulary

Biologist	a scientist who studies the science of life in all its forms, especially with reference to origin, growth, reproduction, structure, and behavior
Biotic community	an association of living organisms having mutual relationships among themselves and to their environment, and thus functioning, at least to some degree, as an ecological unit
Botanist	a scientist who studies the science of plants
Bryozoan	the moss animals
Camouflage	an organism with a physical appearance which blends into its environment
Candidate species	any species or subspecies of bird, mammal, fish, amphibian, reptile, or plant that is being considered for listing as endangered or threatened by federal or state governments
Carapace	the shell of an animal, like a turtle or crab
Carnivore	term commonly applied to any animal whose diet consists wholly or largely of animal matter
Carrying capacity	the maximum population that can be sustained in a habitat over the long term; usually refers to a particular species, but can be applied to more than one
Commensal relationship	two or more organisms living in close association, in which one may derive some benefit, but neither harms the other
Community	an association of living organisms having mutual relationships among themselves and to their environment, and thus functioning, at least to some degree, as an ecological unit
Competition	struggling for the same resources
Consumer	a species that relies on other plants or animals for food
Continental shelf	the sea floor bordering the shoreline, on average about 30 miles wide, that then breaks off into the deeper water of the continental rise and the abyssal plain
Cordell Bank National Marine Sanctuary	a sanctuary 52 miles north of San Francisco that protects the productive fisheries of the Cordell Banks which is poised on the edge of the continental shelf
Critical habitat	a specific area of land occupied by an endangered species

Cryptically colored	having a shell or skin that blends in with the environment and therefore protects an animal from being seen by a predator
Decomposer	an organism, usually a bacterium or fungus, that breaks down the cells of dead plants and animals into simpler substances; these are sometimes called nature's recyclers
Density	the number of organisms or items per unit area or volume
Detritus	organic material formed from decomposing organisms
Diatoms	tiny, single-celled algae that form at the bottom of the food pyramid
Distribution	the arrangement of a species in a given environment
Diversity	the array of species present and their spatial distribution (i.e., biodiversity)
Dominant plant	a plant that is present in large numbers in an area or habitat and by its presence defines the habitat
Ebb	the flowing back of the tide as the water returns to the sea
Ecosystem	a system formed by the interaction of dynamic and interrelating complex plant and animal communities of organisms with their nonliving environment
Ecosystem inventorying	a count or estimate of all the given species in a particular ecosystem
Ecosystem monitoring	to keep track of species within an ecosystem for purposes of detecting long term trends and disturbances
Endangered species	any species which is in danger of extinction throughout all or a significant portion of its range
Environment	the air, water, minerals, organisms, and all other external factors surrounding and affecting a given organism at any time
Environmental factors	the combined influence of wind, rainfall, temperature, and exposure
Erosion	the loss of soil or rock through wind, rain, or wave action

Vocabulary

Estuary	inlet where ocean water mixes with fresh water
Exclosure	a large net and fence, built around the nests of the snowy plover (endangered bird) to keep predators away from adults and chicks
Exotic species	a plant or animal species introduced into an area where it does not occur naturall; foreign or nonnative species
Exposure	situation with regard to sunlight or wind
Farallon Islands	small jutting islands approximately thirty miles off the coast of San Francisco surrounded by a National Marine Sanctuary that protects the marine ecosystem
Fauna	all the animal species that may occur in an area
Fish	any of various cold-blooded, aquatic vertebrates, having gills, commonly fins, and typically an elongated body covered with scales
Flora	the plants of a particular region or period, listed by species and considered as a whole
Flotsam	material or refuse floating on water.
Food chain	a series of organisms linked together by their feeding habits
Food pyramid	a diagram that shows the relationship between producers and consumers in a food chain. It illustrates the concentration of energy from one level to the next
Food web	the multiple interrelationships between all species in an ecosystem or habitat
Freshwater marsh	a wetland dominated by herbaceous plants under the influence of fresh water
Geologic factors	soil and the rock from which it was derived and how they affect the plants that grow upon them
Gulf of the Farallones National Marine Sanctuary	north and west of San Francisco Bay, this 1,255 square mile sanctuary protects open ocean, wetlands, reefs, beaches and open water for it's habitat value and it's productivity as a fishery
Gull	a gray and white water bird. Any of numerous long-winged, web-toed, having usually white feathers with a gray back and wings

Habitat	the natural environment in which an organism lives; a place that is natural for the life and growth of an organism
Habitat type	a land or aquatic unit, consisting of an aggregation of habitats having equivalent structure, function, and responses to disturbance
Haul-out	the act of seals or sea lions hauling or lugging themselves out of the ocean and onto the shore for various reasons, including warming their body temperatures, giving birth, and molting
Headland	a high point of land or rock projecting into the sea or other water beyond the line of coast
Heroic species	a species that captures our hearts and our minds and focuses our attention on its survival because of the freedom and wildness that it embodies
Human disturbance	damage or disturbance to an area caused by human activity
Hydroid	the asexual stage of certain animals like anemones and jellyfish and a group of animals that grow into branching colonies by budding; these sometimes look more like plants than animals
Hypothesis	an educated guess or prediction of the outcome of an experiment
Indicator species	a plant or animal that indicates, by its presence in a given area, the existence of certain environmental conditions
Indigenous	originating in and characteristic of a particular region or country; native (as opposed to exotic) to the geographic location of a restoration site
International Biosphere	an area that has been recognized by the United Nations for its worldwide ecological significance. For example, the Golden Gate Biosphere Reserve to which Point Reyes National Seashore belongs
Intertidal	pertaining to the area that is above the low-water mark and below the high-water mark
Invasive	quickly spreading
Invertebrate	pertaining to creatures without a backbone
Key characteristics	the most apparent qualities or attributes that help one distinguish specific parts of the natural world

Vocabulary

Keystone species	a species that is critical to the survival of many others due to its role as a food source or a provider of habitat
Lagoon	a shallow body of water completely or partially separated from the ocean by a reef, sand spit, sand dunes, or some other barrier
Larva	the immature, wingless feeding stage of an insect that undergoes complete metamorphosis; the young of any invertebrate animal
Mammal	any vertebrate having the body more or less covered with hair, nourishing the young with milk from the mammary glands, and, with the exception of the egg-laying monotremes (es. duck-biled platypus), giving birth to live young
Marine algae	nonflowering plants, commonly called "seaweed," that flourish in shallow coastal waters
Marsh pan	a small tidepool in a marsh, or pooled depression on tidal flats
Microorganism	any organism too small to be viewed by the unaided eye, as bacteria, protozoa, and some fungi and algae
Migratory species	an animal that passes periodically from one region or climate to another, such as certain birds, fishes, and mammals
Mudflat	a mud-covered, unvegetated, gently sloping tract of land, alternately covered and left bare by tidal waters
Murre	common name for a group of diving birds of the same family as the auk and the puffin; murres eat small fish and crustaceans and lay their hard-shelled, pear-shaped eggs on bare rock. Murres return to the same breeding sites year after year. Both male and female incubate the single egg laid per season
Mutualistic relationship	two or more organisms living together in a mutually beneficial relationship
National Park Service	people who manage the National Park System
National Park System	areas of national signfiicance, scenic beauty, historic importance, preserved for the use and enjoyment of this and future generations
National Seashore	an area of seacoast set aside and preserved for the public good
Native	an organism indigenous to a particular region

Vocabulary

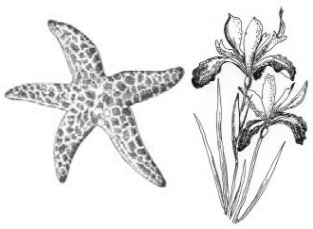
Nearshore waters	the shallow ocean waters within about one mile of the shore
Niche	the ecological role, position, or function of an organism in a community of plants and animals
Nitrogenous waste	waste containing nitrogen
Nonnative species	a species that has been introduced from another place or country
Nudibranch	sea slug. a shellless, marine snail
Nursery	an area where new plants or animals are propagated
Nutrients	particles of decayed marine plants, and animals, minerals and molecules that have been brought to the surface by upwelling waters
Oceanography	the study of the plants, animals, impacts, physical properties, and technology of the ocean
Organic debris	debris consisting of plant or animal material
Partnership	an arrangement between two or more people or agencies that work together for a common goal
Pelagic	pertaining to the open seas or oceans, living or growing at or near the surface of the ocean, far from land, as certain organisms
Perennial	a plant which has a life cycle lasting more than two years; generally a plant dies back seasonally and regenerates from surviving roots or stems the following year
pH	a measure that indicates the relative acidity or alkalinity of a substance. The pH scale ranges from 0 (most acid) to 14 (most basic), with 7 being neutral
Plankton	microscopic plants and animals floating on the ocean's surface; the primary food source of many marine animals
Plant community	the plant populations existing in a shared habitat or environment
Pod	a group or school of seals, dolphins, porpoises, or whales
Population	the number of organisms of the same species that occur in a particular place at a given time
Predator	any organism that exists by preying upon or hunting other organisms
Prey	an organism that is hunted by another species for food

Vocabulary

Producer	a species that harnesses the sun's energy through photosynthesis to grow
Productive nutrients	nutrients that aid in the growth of plants
Rare or endangered species	a species of animal or plant listed that is rare, threatened, or endangered
Refuge	an area set aside to protect plants and animals
Restoration	returning something to its original state
Roe	the mass of eggs or spawn of the female fish
Salt marsh	an area that is characterized by periodic flooding due to tidal changes
Scat	the excrement of an animal
Scavenger	an animal that eats dead or decaying matter
Sea stack	a tower of coastal rock detached from a cliff-lined shore by wave action and surrounded by water
Sensitive species	a species that is easily affected by disturbance
Shorebird	a bird that frequents seashores and feeds on the sandy beaches and tidepools, waiting for the tides to move in and out, uncovering its food (fish, shellfish, etc.)
Soil	the portion of the earth's surface consisting of disintegrated rock and humus
Spawn	the mass of eggs deposited by fishes, amphibians, mollusks, crustaceans, etc.
Species	the basic category of biological classification, composed of related individuals that resemble one another, are able to breed among themselves, but are not able to breed with members of another species
Splash zone	along rocky coasts, the highest elevational zone (habitat) influenced by tides
Stewardship	taking care of the environment by being involved; taking action and participating in clean ups and education programs, helping others become more aware, and making responsible choices
Storm surge	a change in wave activity due to storms offshore
Stream	a body of water flowing in a channel or watercourse, as a river, rivulet, or brook that supports fish or other aquatic life

Survey	a detailed study of an area
Swash line	the high-tide line on the beach, which is found by looking for wet seaweed, debris, and shells; the area a wave comes up and goes down as it washes the shore
System	a group of related natural objects and/or forces within a defined zone; a more general and less rigorous term than "ecosystem"
Thermal	a rising air current caused by heating from the underlying surface
Threatened species	any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range
Tidal	a situation in which the water level periodically fluctuates due to the action of lunar (moon) and solar (sun) forces upon the rotating earth
Tidal influence	the exposure of intertidal land to periodic inundation of seawater twice daily due to the rising and falling of the tides
Tidal regime	the range of elevations in a wetland experiencing a specific pattern of tidal inundation
Tidal slough	a small, meandering inlet in a bay or estuary
Tide table	a guide that predicts the daily high and low tides of a given area
Tunicate	an animal, including the sea squirt and "salps", considered the most primitive ancestor of animals with backbones, which includes humans
Upwelling	the current that brings cold nutrient rich water from the deep ocean to the surface
Wildlife habitat	an area that provides a water supply and vegetative habitat and food for wildlife.
Wrack line	the line of debris left on the beach by changing tides
Zones, zonation	differentiated areas of habitat characterized by a particular set of plants and animals, whose presence is determined by environmental conditions
Zooplankton	small (often microscopic) aquatic animals suspended or weakly swimming in water

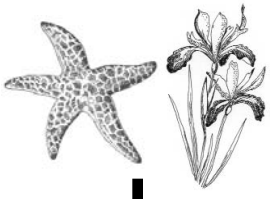
Creating
Coastal Stewardship
through Science



Defining Habitats

Pre-Visit Activities

How Do We Identify the Plants and Animals of Point Reyes National Seashore?



Through a hands-on activity, students will learn observation techniques and become familiar with important characteristics used to identify common wildlife and plant species found at Point Reyes National Seashore. Students will also identify the most common species found in various habitat types by reading a newspaper specific to this unit.

Time required: 30 minutes

Location: classroom

Suggested group size: entire class

Subject(s): science

Concept(s) covered: natural history

Written by: Steve Anastasia and Lynne Dominy, National Park Service

Last updated: 10/09/00

Student Outcomes

At the end of this activity, students will be able to:

- Identify observable species using "key characteristics" that can be used to identify plants and animals in any natural area.
- Understand the complexity and interactions of the habitats found at Point Reyes National Seashore through reading the "Defining Habitats" newspaper.

California Science Standard Links (grades 6–8)

This activity is linked to the California Science Standards in the following areas:

6th grade
- 5a- food webs
- 5b- organisms and the physical environment
- 5c- organisms can be categorized by the functions they serve in an ecosystem
- 5d- different organisms may play similar ecological roles in similar biomes
- 7b- use appropriate tools/technology to perform tests, collect/display data

Pre-Visit Lesson Plan

7th grade 7a- use appropriate tools/technology to perform tests, collect/ display data

8th grade 9a- plan and conduct a scientific investigation to test a hypothesis

National Science Standard Links (grades 5-8)

This activity is linked to the National Science Standards in the following areas:

- Content Standard A – Identify questions that can be answered through scientific investigations; Think critically and logically to make the relationships between evidence and explanations.
- Content Standard C – Populations and ecosystems, diversity and adaptations of organisms

Materials

To be provided by the teacher:

- Pencils/pens
- Blank paper (8½ x 11 inches)
- Flipchart paper/blackboard/butcher paper

To be photocopied from this guide:

- **Pre- and Post- Evaluation** activity sheets (one per student)
- "*Defining Habitats"* newspaper (one per student)

Vocabulary

abiotic factors, amphibian, bird, community, ecosystem, habitat, invertebrate, mammals, niche, plant, population, reptile

Procedures

1. **Pre- and Post-evaluation.**
   Distribute "Pre- and Post-Evaluation" activity sheets. Remind students this is not a graded test, but rather a measure of the success of the lessons. Each student will retake the same test after several lessons. (Note: You may choose to save these completed tests and redistribute them in the first post-visit lesson. Students can change their answers based on what they have learned.)

2. **Distribute copies of the *"Defining Habitats"* newspaper to each student.**
   A. Divide the class into eight small groups. Each group will be assigned one of the following habitats: open ocean, estuary, sandy shore, intertidal zone, coastal scrub, riparian corridor, Douglas fir forest, and bishop pine forest. Make sure that students know that some of these habitats are found on multiple pages of the newspaper.
   B. For their specific habitat, students need to list the plants, mammals, reptiles, amphibians, birds, and invertebrates (if present) found in their habitat. Have the students draw simple food chains for any connections identified within the text.

C. Using a large chalkboard or piece of butcher paper, draw the habitat cross-section diagram found on page 6 of the newspaper. Leave plenty of white space on the edges for the open ocean species, intertidal species, and estuary species.
D. Have each student group do a group presentation summarizing the species found in their habitat. List them on the habitat diagram in the location corresponding with their habitat type.

3. **Brainstorming activity.**
   A. What are the important identifying characteristics of each species? (See following Teacher Information sheet, page 50) Have groups of students brainstorm a similar list.
   B. List the potential characteristics for Birds, Plants, Mammals, Amphibians Reptiles, and Invertebrates as a class. A copy of the list is included in the Field Journal.

4. **Wrap up and conclusion.**
   A. As a review, reinforce the importance of the observable behavior and important characteristics in identifying plant and animal species. These characteristics and skills will be used in the field observations at Point Reyes.
   B. Compare your list with the "Identifying Plants and Animals in the Field" Teacher Information sheets on the following pages.
   C. Add any important characteristics that are not currently on the list.
   D. Summarize the continuum of individuals to ecosystems using the Habitat recipe:

      Individual species make up Populations.
      Multiple populations make up Communities.
      Communities + abiotic factors = Habitats.
      Many habitats = Ecosystem.

Extension Activities

1. On school grounds or as a homework assignment at home have each student record data for one or two species that they find in their surrounding environment.
2. Watch a wildlife video without any sound. Try to identify characteristics that will help you identify the different species.
3. Create a picture mural of one or more of the Point Reyes habitats. Have the students draw the species or cut out pictures from various handouts or magazines. Expand this mural out into the open ocean habitats found in the Gulf of the Farallones National Marine Sanctuary. A very nice brochure that summarizes all of the offshore environments is available from the Sanctuary for free (see Resources).

Pre- and Post-Evaluation

Teacher Master

Vocabulary Match-Up

Draw connecting lines between words and their definitions.

Habitat	the ecological role, position, or function of an organism in a community of plants and animals
Biodiversity	place that is natural for the life and growth of an organism
Niche	a system of plants, animals, and nonliving components that interract in a complex relationship
Ecosystem	the number of species in a given habitat and the communities, ecosystems, and landscapes in which they occur

Match Species with Their Habitat

Write one of the following species next to the habitat in which they are most likely to be found: eelgrass, western snowy plover, cow parsnip, coast live oak, and coho salmon

HABITAT:	SPECIES:
Mixed Woodland	***coast live oak***
Coastal Scrub	***cow parsnip***
Riparian	***coho salmon***
Sandy Beach/ Coastal Dune	***western snowy plover***
Estuary	***eelgrass***

National Park System

Which part of the National Park System is closest to where you live?

Point Reyes National Seashore, Muir Woods National Monument, Golden Gate National Recreation Area

True or False?

T/(F) Ice plant is native to California.

T/(F) Fallow deer have been in California for thousands of years.

(T)/F Tule elk are native to California.

Stewardship

What can you do to insure diverse habitats remain healthy in your local area and in Point Reyes National Seashore? List your ideas on the back of this paper.

answers will vary

Pre- and Post-Evaluation

Activity Sheet

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Defining Habitats

of Point Reyes National Seashore

What's Inside

Author's Note

It is important to consider how the influences and impacts of the plants and animals of the past have shaped the present. Landscapes of the past are invoked—salmon-swollen creeks, elk herds on the hills, canyons echoing with the cries of cougars—not because I believe they may possibly reappear, but because conjuring them into our imagination as we wander the hills and the seashore enlivens the present landscape with the shadows of our ancestors.

As you read these articles about Point Reyes and visit its beaches, estuaries, forests, and grasslands, ask yourself "What is the value of this place?"

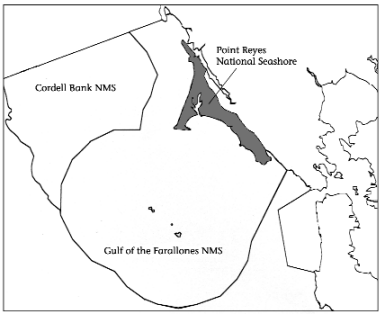
Some things are not easily counted or quantified, yet are no less significant. It is for these reasons that we carefully look after Point Reyes.

Jules Evens

Daisies by the Sea, by Bobbie Belvel

The Pacific Ocean surrounds the Point Reyes Peninsula—waves washing over beaches, breakers crashing into cliffs, spray drenching the sea stacks scattered along the shore. Even the fog that hangs over the hills is salty from the sea. Seen from the Lighthouse or from Limantour Beach, the ocean seems to have a uniform sameness, a vast monotony. Quite the opposite is true. Like forests and fields on the land, the ocean is a patchwork of habitats that reach from the deepest offshore waters to the highest splash zone. And where the ocean meets the land the greatest array of habitat types occur—bays, lagoons, estuaries, tidepools, tidal sloughs, marshes, tide pans, and beaches.

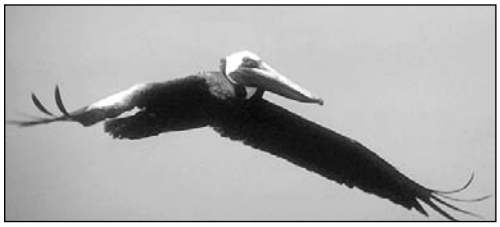
Open Ocean



Imagine that you're a brown pelican flying from the Farallon Islands to Point Reyes National Seashore. As you leave the rocky shore at the Farallones you take a wide arc out to the west for a few miles. There you see a pod of blue whales, the earth's largest mammals, travelling south. They are following the continental shelf, a steep submarine cliff that drops off into onto the abyssal plain, about 35 miles offshore. This change in underwater topography causes a current of cold water from the deep ocean to mix with warmer surface waters, a process known as upwelling. Cold water has more oxygen and therefore "holds" more nutrients than warmer water. Because of this "super oxygenation," many small oceanic organisms—tiny shrimplike creatures called krill and schooling fish—occur in this cold "upwelled" water at the edge of the continental shelf. Pacific gray whales also frequent these waters annually as they travel south to Baja to give birth to their young, then later on their northward journey back to Alaska to feed.

"Discovery consists of looking at the same thing as everyone else and thinking something different." **—Albert Szent-Györgyi**

From Ocean to Estuary



Pelican in flight, Rich Stallcup

Being a pelican, you dive into the cold water in the wake of the whales and snack on a few anchovies before taking off again and flying toward shore. It's a long flap in, across miles of boundless ocean. On the way, you occasionally see other creatures—a blue shark cruising just beneath the water's surface, a white shark eating a harbor seal, some common murres diving for sardines. Some large moon jellies float by, and then you even see a huge turtle, a leatherback, munching on one of the jellyfish!

You know you're closer to shore when you notice more birds like surf scoters and cormorants; there seem to be more marine mammals in the water too—especially harbor seals and California sea lions. These animals congregate in these nearshore waters because it is shallow and there are plenty of places for them to get out of the water to rest, breed, and bear young. Even an animal as oceanic as a northern elephant seal must find a safe place on the shore, called a "haul out", to sleep, breed, and birth its pups. As you circle the rocks just off the Lighthouse, you notice a family pod of harbor porpoises breaking the surface of the water.

Flying along the shore near Limantour Beach you see a school of topsmelt or surfperch just below the breakers. As you dive into the sea to catch some more fish, some other pelicans join you. When you scoop some smelt in your bill, a few manage to wiggle out. An annoying seagull—a dark one with a red bill, called a Heermann's gull—is there to grab your leftovers. These seagulls are called "pirates" because this is the only way they seem to be able to find food, by stealing from clumsy pelicans. Approaching the shore you fly low, catching the updraft of the breakers, bank, and land at the end of Limantour Spit amidst a flock of a hundred other pelicans. All have bellies full with smelt, resting and roosting with the harbor seals and gulls that also gather here, away from the disturbances of humans and dogs.

Estuary by Bobbie Belvel

Estuaries

The tidal marsh that surrounds the estuary provides a transition from ocean to land. Here, freshwater streams meet the saltwater tides creating one of the most fertile ("productive") habitats on earth. Fast growing salt marsh vegetation—cordgrass, pickleweed, and salt grass—provides habitat for its own decomposers (bacteria and amphipods). The estuaries act as the doorways for oceanic fish, such as coho salmon and steelhead trout, to travel into freshwater streams to spawn. They also provide prime habitat for ducks—such as the mallard, green-winged teal, and northern shoveler—to feed. Osprey frequent estuaries to hunt fish, as do snowy egrets and great blue herons.

Coho salmon, NPS Collection

The pelicans can't see beneath the surface, but riding into the estuary on the rising tide are leopard sharks and other fish— Pacific herring, rubberlips, and topsmelt—entering the estuary to take refuge in the meadows of eelgrass that sway beneath the water. You can find the eelgrass, washed up on earlier tides and decomposed, along the shore of Limantour. The eelgrass beds harbor other animals too. Animals with strange names—nudibranchs, hyrdroids, sponges, tunicates, skeleton shrimp, "fixed" jellyfish (they are attached to the grass, not free-swimming like we think of jellies), bubble-shell snails, sea hares, periwinkles, sea slugs, tube worms, limpets, grass shrimp, razor clams, and sea cucumbers—live on the blades. In the roots on the bottom (benthos) are animals that live in the mud and siphon microscopic food from the water—clams, feather-duster worms, fat innkeepers, for example. The eelgrass beds are teeming with creatures that live there always, but the grass also provides food for animals who are passing by, like the sea goose called the black brant. Pacific herring, one of the most abundant fishes, and a favorite food of the pelican, come to lay their eggs here. The arrival of the herring is signaled by the flocks of seabirds that come to eat the herring roe. Loons, grebes, scaup, and scoters congregate above the eelgrass pastures, stuffing themselves on the buffet.

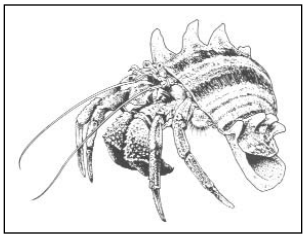
The tide is rising. A surge of cold water floods into the estuary, bringing in nutrients—particles of decayed marine plants and animals, minerals and molecules—that have been brought to the surface by the upwelling waters. The life of the estuary is determined by the tides that wash in and out twice daily. The plants and animals that live in the estuary rely on the tide to bring them nutrients, but they also must deal with the problem of being covered with salty water, or exposed to the dry air. These two contrasting conditions require certain adaptations, and each species of plant or animal has a different ability to withstand the stress of being under water, above water, or both. To deal with the tidal changes, groups of organisms are distributed at different tidal levels, or

Into the Mud Flats

Mud flats, Bruce Farnsworth

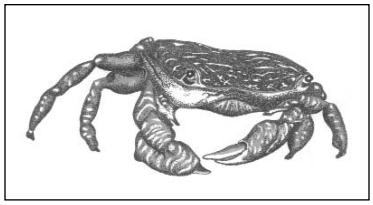
zones, within the estuary, depending on the amount of time they must stay above or below water. We will consider these communities from the deepest channel, which is almost always covered by the ocean water, to the edge of the land that gets soaked by only the highest tides.

In the deepest water of the estuary, amidst the blades of eelgrass are a myriad of small and camouflaged (cryptically colored) organisms that are difficult to see with the naked eye. Dainty little snails (*Nassarius*) are abundant—grazing on small algae that grow on the grass blades. Some of these snail shells are not occupied by the original snail, but have been taken over by hermit crabs that use the shells for their own.

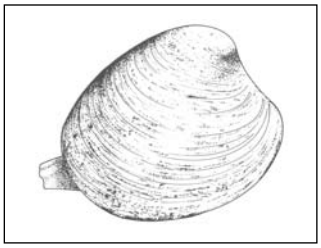


Hermit crab, NPS Collection

Eelgrass can grow in channel bottoms and deep basins within the estuary, but much of the bottom is flat and exposed to the dry air for longer periods of time. These "mudflats" or tidal flats support their own unique community of plants and animals. Because the mud flats have few places for animals to attach, the sea stars and urchins of the rocky shore, or the sponges and moss animals of the eelgrass beds are largely absent. Healthy tidal flats are colonized instead by vast cities of worms, clams, and snails. Most of these mud flat dwellers are burrowers and "deposit feeders." In the "low intertidal" flats or zone next to the eelgrass beds, the areas that get the most tidal flow, live some of the larger clams, most notably the geoduck, pronounced "gooey-duck." The geoduck lives in the gooey-est muck in a deep burrow that can be up to 5 feet deep. Any disturbance at the surface signals the clam to retract its enormous siphon that causes a spout of water to shoot up. Geoducks can live at least 15 years and grow as large as 12 pounds. Another big clam in this lowest zone is the gaper clam; it also has a squirt hole in the mud that may surprise you with a spout as you walk across exposed mud flats. Gapers only get to be about 4 pounds in size. When the tide is in, these clams have their siphons extended to suck food from the water. They have to be careful, however; leopard sharks and bat rays ride in on the tide and try to snip off the siphons with their razor-sharp teeth.



Shore crab, Lisa Halton



Clam, NPS Collection

Another common low intertidal clam is the Washington clam, also called the "money-shell" clam, since the native Californians used the shell for money. If we could see a cross section of the low intertidal flats, we'd see all the clams burrowed beneath the surface and there would also be a U-shaped hole that housed perhaps the most curious of all the mud flat inhabitants—the fat innkeeper worm. The innkeeper is about the size of a fat cigar, and is called an "innkeeper" because of all the guests that share its big burrow. Because the innkeeper is so good at getting food, three other creatures hang out in the burrow waiting to eat the leftovers, or the morsels he drops—like the scavenger gulls that follow the pelicans around. These three guests include a red scale worm, a goby fish, and a pea crab. Flounders and bat rays apparently can extract bottom dwelling animals like the innkeeper, by using their broad, flattened bodies like a plumber's helper and suctioning the prey out!

Higher up, where the mud flat meets the shore and in the tidal sloughs that meander through the tidal marsh, the most obvious animal is the Oregon shore crab, *Hemigrapsus*. Squarish, dull green, and not very large, "Hemi" burrows in myriad holes along the bank. Shore crabs feed mostly at night on diatoms and green algae that grow along the muddy shore, picking at their food with each claw. Mussels live along the upper shore as well, especially in undercut banks. Look for raccoon tracks in the mud along the shore; they seem to come to hunt primarily for crabs and mussels. Snails too are common on the higher mud flats, especially the channeled basket whelk and tall-spired horn snail. The horn snail is most easily found in the marsh pans (small tidepools in the marsh) where it grazes on detritus and diatoms covering the mud. Basket whelks are carnivores, however, and will eat both dead and live meat. The fact that basket whelk migrate down to the eelgrass beds to deposit their egg capsules is another example of that habitat's value as a nursery.

Willets, by Patricia Kirby

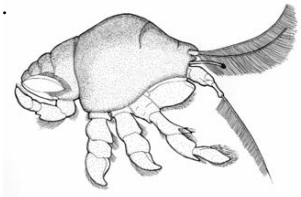
Along the Sandy Shores

The Great Beach, Sue Van Der Wal

Most of the animals that live on the beach bury themselves in the shifting sands, moving up and down the beach as the waves break and the tide turns. One of the most common animals of the lower beach, the mole crab, has to be able to burrow very quickly to move with each incoming wave and avoid being eaten by the sandpipers that are also following the waves in and out. Seaweed and other flotsam gather on the upper beach, washed by only the highest tides and biggest waves, along what is called the wrack line. Sometimes, especially after a strong storm, the wrack line is a tangle of bull kelp and feather boa algae, and if you sift through this smelly detritus, you'll find the other most common inhabitant of the outer beach, the beach hopper.

Unlike the estuary that produces its own food sources—sea lettuce, diatoms, microscopic algae, and eelgrass—little sustenance is produced by the sandy beach. The major source of food in this habitat is either plankton washed ashore by the waves, or the dead seaweed and corpses of fishes, birds, and marine mammals cast ashore by the waves. Look for the egg-shaped shells, or carapaces, of the mole crabs scattered along the beach. You should be able to find them since many are left behind by sanderlings or willets after they've eaten the body of the crab. The shells are ivory colored and about the size of your thumb. The following is a description of their feeding habits:

> When in the sand, the mole crab always stands on end, head end up and facing down the beach toward the surf. Characteristically, the entire body is buried, while the eyes (tiny knobs on long stalks) and the first pair of antennae (which form a short tube for respiration) project above the sand. When a wave starts to recede down the beach, the sand crab uncoils its large second pair of antennae (like small feathers) and projects them in a V against the flowing water to gather minute organisms . . .

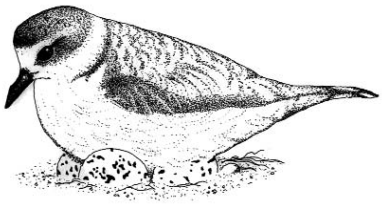


Mole crab, Christie Anastasia

Mole crabs can be in very dense aggregations, concentrated in the wet sand where the waves are breaking. Not only are they constantly being preyed upon by shorebirds, but when a large wave washes in, surfperch try to eat them as well, so they are being hunted on both the inwash and the outwash of the wave.

Another common animal, though rarely seen, is a red worm that burrows in the sand a few feet above the tide. These worms feed by swallowing grains of sand and digesting the detritus that has gathered on the grains, in effect cleaning the beach. Beach hoppers, or amphipods, are about the size of a pea; you can find them under the wrack on the upper beach, but they are most active at night. Although amphipods avoid the waves, they like to stay moist in the wet seaweed. The beach hoppers are decomposers—they eat, or break down, the dead things that wash up on the beach. Other scavengers that occur on the beach include turkey vultures and gulls. Also, judging by the tracks that follow the tide line in the early morning, skunks, foxes, and raccoons visit the beach at night in search of a fresh bird or fish carcass. All these beach janitors are recyclers of the highest order.

Just beyond the grasp of the highest tides, a coastal dune community exists. This dry, sandy habitat is host to many plants such as the American dune grass, sand verbena, saltbush, beach strawberry, dune lupine, and beach morning glory. The dunes provides a safe resting place for many animals, especially during high tide and at night. In the more remote beach areas large flocks of birds—pelicans, gulls, shorebirds—congregate. One bird in particular lives on the beach and relies on it not only for roosting, but also builds its nest in the dunes. The Western snowy plover, a small, pot-bellied shorebird, nests here at Point Reyes and raises its chicks along remote stretches of beach. They probably eat the beach hoppers as well as other small invertebrates that venture out onto the sand. Because the snowy plover is endangered, the Seashore has set aside certain beaches for its protection and restricted people from walking dogs there. Also, because plovers are being preyed upon by ravens, the biologists have constructed "exclosures", large nets and fences around the nests that keep predators away from the adults and chicks.



Snowy plover, Lisa Halton

Occasionally when walking the beach you'll find jellyfish washed up along the shore. One of the most peculiar looking of these doesn't even look like a jelly. The "by-the-wind sailor," also known as Vellela, looks like a rumpled piece of cellophane with blue or purple dye along its edges. Under certain conditions Vellela will be strewn in lines for miles down the beach. What are these conditions? As the name "by-the-wind sailor" suggests, Vellela is distributed by the wind and appears on our shores usually in spring after the first strong westerly winds of the year, having been blown here from somewhere out in the middle of the Pacific Ocean.

One of the attractions of the beach is the possibility of finding just about anything that has been washed in by the tide. Most common are big "moon jellies," bull kelp, dead seabirds (especially murres, grebes, and scoters), sea lion carcasses, and driftwood. In the driftwood look for goose barnacles that have attached themselves at sea, or the European shipworm which bores through wood with the rasplike teeth on its shell. Other common finds include sand dollars, and the shells of razor clams, olive snails, and shore crabs.

Intertidal Zone

Halfway between land and sea, on the rocky shelf where waves break against rocky outcroppings, is the intertidal zone, a realm inhabited by fabulous creatures that look as if they came from another world. Check a tide table for low tide times, dress to protect yourself from wind, and wear shoes that can get wet and still give good traction. Then tread cautiously. Be careful not to disturb or destroy the creatures that make the intertidal zone their home. Now you can discover the delicate and other-worldly magnificence of the tidepool.

What is the Intertidal Zone?

In the intertidal zone, the ocean rises and retreats twice each day. Its inhabitants are exposed alternatingly to immersion in salt water and exposure to air. The animals that survive in this sometimes wet and sometimes dry habitat are mostly invertebrates. Many of the plants are algaes.

The high intertidal zone is the area closest to the beach, which is covered with water only once or twice a day during high tides. Here, look for ribbed limpets, acorn barnacles, eroded periwinkle, small-shelled snails, black turban snails, rockweed (a type of brown algae), and lined shore crabs.

In the middle intertidal zone, the area that is exposed at least once a day due to tidal fluctuations, you will find California mussels and the olive green aggregated anemones. These animals cover themselves with sand and bits of shell to prevent loss of water from exposure to wind and sun. Look for ocher stars, mossy chitons, goose barnacles, and sea lettuce.

In the low intertidal zone, the area that is exposed only during a very low tide, look for purple sea urchins thriving amid the strong wave action. One may also find the bat star, a sea star which is webbed between its arms. Giant green anemones, up to 17 cm wide and a vivid olive green with brown tentacles, and coralline algae, an encrusting pinkish lavender/red algae, grow in this zone.

Listening to Plants

***"When I discovered a new plant, I sat down beside it for a minute or a day, to make its acquaintance and hear what it had to tell . . ."*—John Muir**

The diverse array of plants at Point Reyes National Seashore can tell us many stories of time and change. The windswept grasslands near Tomales Point tell of tule elk roaming the hills of coastal California. Charred blackened trees and small pine seedlings are reminiscent of the Vision Fire racing down Inverness Ridge burning and reinvigorating everything in its path. The open rangelands tell us stories of placid dairy cattle making their way home through the fog to the milking barn, and of the smiling faces of travelers witnessing spectacular wildflower displays near Chimney Rock. Today, the plants of the Seashore tell the story of competition—competition between the native plants that belong here and the nonnative species that have been introduced.

Rare Sonoma spineflower, NPS Collection

The native plants of Point Reyes National Seashore reflect our past and set the stage for our future. Evolving alongside animals, fungi, and microbes, they form complex ecological webs. Native plants play critical roles as oxygen producers, decomposers, water purifiers, soil developers, and providers of food and habitat for wildlife. Without them, the land we have come to know as Point Reyes would be significantly different.

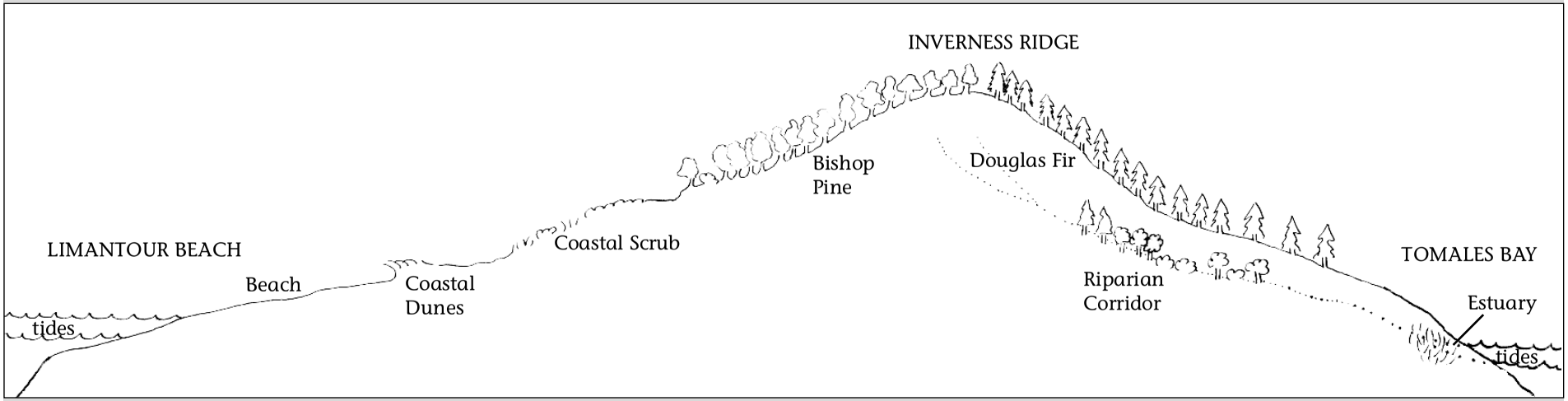
As native systems have been altered in other areas of California, many native plants have been pushed to the brink of extinction. Point Reyes National Seashore serves as a refuge for an astonishing number of these rare plants. Forty-seven of Point Reyes' plant species are considered rare. Hundreds of their populations are scattered throughout the Seashore where habitat has not been subject to extensive development. Offering the last chance to protect them from extinction, these rare plants are actively monitored and managed by park scientists. The rarest of the rare, Sonoma spineflower (*Chorizanthe valida*), occurs naturally in one population in coastal prairie habitat. Prior to 2000, this was the only population known to occur in the world. This year, however, NPS vegetation managers succeeded in establishing a second population in similar habitat in the Seashore.

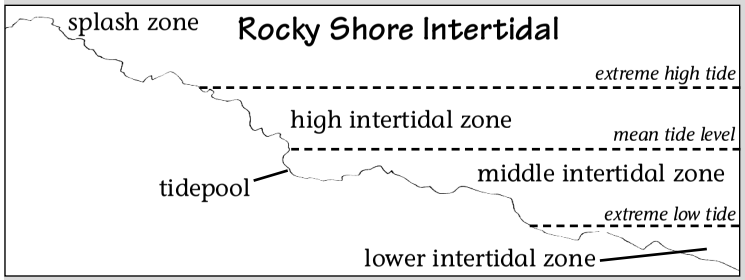
One of the most critical threats to the rare plants and native habitats of Point Reyes National Seashore is the presence of nonnative plant species. Introduced from early settlers, their animals, and landscape plantings, nonnative plants and seeds have taken root at Point Reyes. Invasive nonnative species tend to spread very rapidly and form dense monocultures out-competing native plants for scarce space and resources. Over time, invasive plants can dramatically alter ecosystems that have been in place for thousands of years.

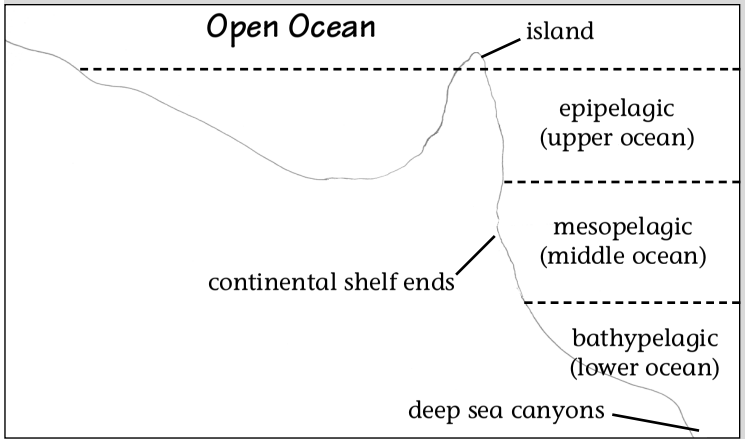
Volunteers removing nonnative Scotch broom, NPS Collection

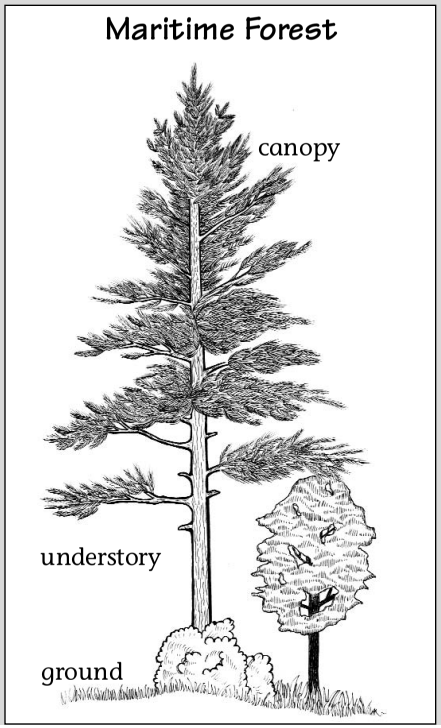
Keeping the stories told by native plants alive in the landscape is a daunting and difficult task. To curb the tide of many of the Seashore's nonnative invasive plants, volunteers are recruited to remove the most threatening species. With a limited amount of money and time, there is no way to stem the tide of all nonnative species nor bring back all the habitat that has been lost or altered. But we can work together to keep Point Reyes' plant communities as healthy and diverse as possible so the stories told by the plants of the Seashore will continue well into the future.

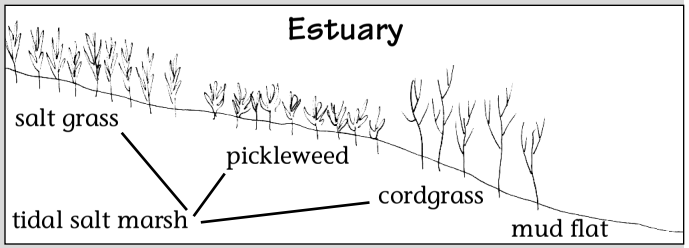
Habitats of Point Reyes National Seashore











Douglas Fir Alliance

The Douglas Fir habitats (and all other plant habitats) are actually a mosaic of plant associations based on soils, sun, water, and historical disturbances. Five associations have been identified at Point Reyes National Seashore for the Douglas Fir:

Douglas Fir - California Bay - Western Sword Fern
Douglas Fir - Coyote Bush
Douglas Fir - Coast Live Oak
Douglas Fir - California Bay - Coffeeberry
Douglas Fir - Tanbark Oak - Coffeeberry

Exploring the Landscapes

Turkey vulture, NPS Collection

Turkey vultures fly high over the land, continually searching, ranging far and wide, from the shoreline to the ridge top. Everything is connected by the passing shadow of this bird.You can recognize its silhouette —long wings with fingerlike flight feathers outstretched, rarely flapping, often rocking from side to side as it flies. All day long it cruises over the landscape, usually flying alone or in small flocks, along the sandy beach, across the coastal scrub and prairie, over the forest of Douglas fir, bishop pine, live oak, and bay laurel.

Mountain Lion, NPS Collection

California poppies, NPS Collection

California quail, NPS Collection

Turkey vultures are scavengers and carrion eaters, which means they devour only dead meat—a seal that has washed up on the beach, a road-killed deer, a cow or elk that has died a natural death out in some pasture. This serves a very important service to the environment. By devouring freshly dead animals, vultures reduce the opportunity for diseases to breed. The digestive juices of the turkey vulture are among the strongest enzymes in nature, capable of breaking down powerful microorganisms, like the infectious bacteria anthrax (*Bacillus anthracis*) that thrives in decaying cattle and sheep and usually results in the slow and agonizing death of any warm-blooded animal that gets infected. The vulture, therefore, is nature's sterilizer, cleaning up the landscape for the health and safety of all.

Vultures, soaring machines that they are, especially like the hot air currents called thermals, that rise off the ground as the day heats up. Therefore, they tend to be in warmer areas (very rare in northerly places like Canada) and most active during the middle of the day. Thermals do not occur over water, so vultures stay over the land; you'll almost never see a vulture venture out over the ocean! When you see a vulture overhead, think about the habitat they are soaring over and the animals that live there; just about any of them is potential vulture food. Do you think a rabbit, or a squirrel, or a quail is concerned when it sees a vulture fly over? If yes, why? If no, why not? Let's think about the vulture's environment, and the species that live there.

Coastal scrub

From a turkey vulture's perspective, the coastal scrub—those large sloping hillsides that reach from the ridge top nearly down to the beach—is an ideal home. The breeze from the ocean provides continual air currents to catch, there are few trees so it's fairly easy to see thing, and the vegetation supports a large variety of animals that are potential food items.

Trees are few in the coastal scrub; only a bishop pine or Douglas fir scattered here and there. The name "scrub" refers to the abundance of bushes that are the dominant plant form in this habitat—coyote bush, poison oak, bush lupine, ceanothus ("blue blossom"), and huckleberry— to name a few. Coyote bush is the most common and is the indicator plant of the coastal scrub habitat. It is an evergreen shrub, three to six feet tall with stiff, bright green foliage and small white flowers. The coyote bush community provides cover for many mammals and birds, including deer mouse, brush rabbit, gray fox, coyote, spotted skunk, black-tailed deer, tule elk, California quail, bobcat, and mountain lion. The fox and rabbit are among the most common of these; if you find fox scat, the fur in it is most likely that of the brush rabbit.

One of the most obvious flowers you'll see is bush (or "sticky") monkey flower (*Diplicus aurantiacus*) with sticky green leaves and salmon-colored flowers that bloom almost year-round. Also long blooming, but bright scarlet in color, is Indian paintbrush (*Castilleja*). Anna's hummingbird is a year-round resident in the coastal scrub, largely because of these two abundant and often available food plants. Other showy spring flowers include the California poppy and Douglas iris.

One of the world's most beautiful reptiles can also be found here in the warmer months, the red-sided garter snake (*Thamnophis sirtalis*). Its diet includes many of the smaller animals that also live in the coastal scrub—tree frogs, banana slugs, salamanders, spiders, earthworms, and even small mice and birds. Of course, the snake may be eaten by any of a variety of predators, too—coyote, northern harrier, raccoon, and striped skunk.

Whenever a nonnative species is introduced into a habitat there is potential for dramatic change to occur. Some nonnatives are aggressive and compete with the native species for habitat and food. Others may introduce foreign parasites and diseases. Studies are being conducted at Point Reyes National Seashore to answer the following questions:

- What are the effects of the bullfrog on the federally endangered California red-legged frog?
- Are fallow deer competing with the native black-tailed deer and the tule elk?

Knowing which species are the greatest threats will help researchers determine how to best protect the native species.

Nonnative fallow deer, NPS Collection

From Streams to Forests

Riparian corridors

Riparian means "streamside," and refers to the thickets of large shrubs and trees that grow only along the banks of creeks and streams. The dominant plants of the riparian thickets in Point Reyes National Seashore are yellow willows and red alders, both deciduous tree species that lose their leaves and bud out in early spring. Riparian plants like to have their roots damp all the time and therefore grow only in the lowest portions of the watershed. Blackberries, stinging nettle, horsetails, and miner's lettuce are common plants found in the riparian understory. The environmental benefits of riparian plants are many. Beneficial bacteria grow on their roots; these bacteria have the ability to take nitrogenous waste out of the groundwater, "fix" it and release it into the water as nitrogen, a basic food source for microorganisms. For this reason, this process is called nitrogen fixing.

Many of the animals that live in the riparian zone—especially fish and amphibians— require cool water to survive. The overhanging willow and alder foliage shades the water and keeps it cool in the warm summer sun. The root system of the vegetation twines out of the streambed, slowing the water and providing hiding places and attachment sites for many invertebrates, animals like opossum shrimp and caddisfly larvae, which are food for young trout and salmon. The leaves of the trees fall into the stream and break down, giving nutrients to the streambed that can be eaten by the small decomposers.

Why do we call the riparian habitats corridors? Watercourses flow from high ground to lower ground, through a variety of habitats. Because they are long and narrow, like hallways, they provide corridors, or runways of movement for animals from the highlands to the lowlands. These corridors are of special importance to migrating birds, but are also critical to amphibians such as California red-legged frogs, tree frogs, banana slugs, newts, and salamanders. Mule deer take shelter from the midday sun in their shade. Great horned owls and northern spotted owls sleep in the shade of the willow tree or nest in a hollow stump of an alder tree.

California red-legged frog, NPS Collection

Banana slug, NPS Collection

Douglas fir forest

If you walk through the fir forest—at Sky Trail, or Bear Valley—on a foggy day, on a day when it's too damp and cold for turkey vultures to fly, you'll notice how moist the ground is; you'll feel the fog drip from the boughs of the trees overhead. Douglas fir trees are very adept at capturing moisture out of the air, and even when it's not raining, it may feel like rain within the forest. Scientists have found that the precipitation beneath fir trees is twice the annual rainfall. At Point Reyes, where the annual rainfall averages about 40 inches a year, the total precipitation in the fir forest may be more than 80 inches! (How tall are you? Compare your height with the annual rainfall and the total precipitation in a fir forest). This ability to capture moisture in the air insures that the ground will be recharged (or rehydrated) by the trees and ultimately provides the foundation for a diverse forest. The Douglas fir forests of Point Reyes may be shared by the California bay and a varied understory of California coffeeberry, California hazel, red elderberry, ceanothus, poison oak, huckleberry, and thimbleberry. The mixed woodland forests surrounding the Douglas firs contain coast live oaks and tan oaks that provide habitat and food for many species including the acorn woodpecker. Two types of deer are commonly seen in these forests although the black-tailed deer is the only native species.

Douglas fir cones, Bruce Farnsworth

The Douglas fir is a grand tree; some individuals within the Seashore rival redwoods in girth and height. Like bishop pines, Douglas fir forests thrive following a fire. The seeds germinate readily, but only those seedlings survive that receive direct sunlight and whose roots come in contact with mineral soil. Therefore, before a new forest can become established, some event must clear the mother forest, provide a bed of mineral soil, and reduce competition from other trees. Fire is the only natural event that provides these conditions.

Bishop pine forest

Overhead, the turkey vulture soars, silently watching the world below. On a pale granite outcrop, silhouetted against the gray skies of summer, a bishop pine (*Pinus muricata*)—trunk awry, limbs askew—stands sentry over the rolling grasslands that stretch toward the dunes of Limantour Beach and the swollen surf beyond. Hidden in the tufted clusters of long needles that splay from the ends of the smaller branches, a Steller's jay sounds a scolding "caw". Molded by the contrary forces of wind, substrate, and available moisture, these contorted conifers lend a twisted grace to the landscape and more than any other species, symbolize the unique and natural beauty that encompasses Point Reyes.

Although once widespread, bishop pines now occur in relict stands, scattered along the humid coastal region of California. Point Reyes hosts one of the most extensive and picturesque groves. Heavily influenced by soil, slope, and microclimate, bishop pines vary in shape and size.

Forests . . .

Bishop pine cones, Bruce Farnsworth

While some trees grow lanky, straight, and tall, many are short and ragged in appearance. One of the most unusual characteristics of this tree is the large, heavy cones located on the main branches and trunk of the tree. The cones are arranged in tight whorls, their scales sealed closed with pitch. On a hot day, one can hear the cones crackle as the dried resins release the scales, freeing the seeds to fall or be eaten by finches or sparrows. Western gray squirrels also feast on the cones, but they will attempt to gnaw out the seeds before the scales have released their protective grip. Birds, rodents, and wind disperse the seeds. However, this method of regeneration does not compare to the abundance of saplings that sprout shortly following a forest fire. One of the best places to view the regrowth of the bishop pine forests following a large fire is at the Bay View Trail head on Limantour Road.

Other trees share the forest with the bishop pines, but usually as secondary members of the community. These include bay laurel, madrone, California buckeye, California wax myrtle, and occasionally coast live oak. Several rare and endangered species are associated with this habitat. Three species of manzanita and two varieties of ceanothus are found only in bishop pine forests.

Visions of Fire

Just mentioning the word fire is enough to spark fear and concern in most people who live in rural areas, but where does fire fit into the natural ecosystems at Point Reyes National Seashore? The answer is hidden within the rings of old trees. Fire scars in these rings have told us that fire was part of the burning cycle that occurred every 4 to 20 years in the forests of Point Reyes. Historically, these fires cleared brush, reduced fuels, and reinvigorated forest ecosystems. Some were naturally occurring while others were set by Native Americans to encourage the presence of specific wildlife and native plants.

This fire history abruptly ended some 80 years ago when fire was snuffed out at Point Reyes. As ranchers and loggers settled the land, cultural views about fire shifted. Fire was viewed as an unwanted menace that needed to be stopped. It destroyed valuable timber and threatened permanent structures. Some proudly claimed that we had finally claimed dominance over natural processes . . . others knew it was only a matter of time before the story of fire was reignited in the landscape.

That time came when the Vision Fire sparked to life on October 3, 1995. Named for its origin near the summit of Mt. Vision, the fire started from the smoldering remains of an illegal campfire. As many stared with disbelief, the fire raged out of control. Fueled by 80 years of forest litter and strong winds, it seemed capable of consuming the entire Seashore and its surrounding communities. Thirteen days later, with the help of many firefighters, helicopters, and engine equipment, the fire was brought under full control and the whole community breathed a collective sigh of relief. In the aftermath of the fire, 13,000 acres were burned and 44 structures were destroyed. The beautiful scenery of the Inverness Ridge and coastal habitats was charred and nearly devoid of life. In this seemingly ravaged landscape, a dormant beauty was waiting to come to life.

Burned area from 1995 Vision Fire, Bruce Farnsworth

If you visit the area of the 1995 burn today, what you'll find will amaze you. Bishop pine seedlings are thriving and regenerating in areas where they were historically found. Coastal scrub communities have been rejuvenated. Elk, deer, and coyotes roam the hills and northern harriers, red-tailed hawks, and songbirds fill the air. Looking back, the Vision Fire performed decades' worth of restoration over a very short span of time. It also helped bring fire management to the front of everyone's minds.

Today, fire continues to play an important role in managing natural ecosystems. By prescribing controlled burns, resource managers can use fire to reduce fuels found in forests and grasslands and mimic historic fire regimes. Controlled burns can also be used to remove invasive, nonnative species while encouraging native plant species that are the foundation of sustainable, dynamic ecosystems.

While prescribed burning for specific management goals is an extremely useful tool, it is not a silver bullet. It can not solve all ecological problems nor prevent all unplanned fire ignitions. When compared to the devastating nature of wildfires, however, it is the best alternative that exists. Prescribed burns allow managers to target critical areas to burn under ideal circumstances instead of reacting to a fire that is out of control.

No matter how hard we try to manage fire in natural areas, there will always be unplanned ignitions and fires threatening property and lives. But through prescribed burns and the systematic management of fire, the risk of large-scale fires can be minimized. What we need to decide is whether to wait for an uncontrolled fire to find us, or to choose to actively use fire to our advantage? For many, the Vision Fire has already answered that question.

Monitoring Habitat Health

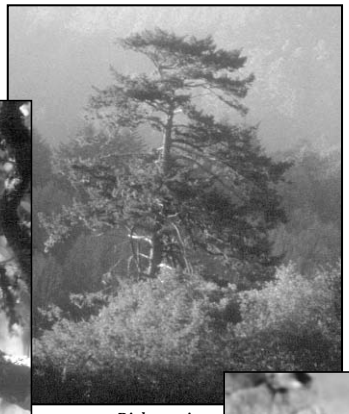
"A thing is right when it tends to preserve the integrity, stability, and beauty of the biotic community. It is wrong when it tends otherwise." **—Aldo Leopold**

When taking a walk or a drive in Point Reyes National Seashore, it's easy to see why the Seashore was established in 1962. Its beauty and wild nature are breathtaking. But is Point Reyes National Seashore ecologically healthy? Are species populations on the rise or in decline? Until a few years ago, very few questions could be answered about ecosystem health. This is changing at the Seashore with the implementation of an Inventory and Monitoring program. With the help of volunteers and partners, this program provides scientists and managers with baseline information and long-term trends within Seashore ecosystems.

Intertidal monitoring by staff and volunteers, NPS Collection

Volunteers are a critical component to many of the inventory and monitoring projects at Point Reyes. Some volunteers come from as far as an hour and half away to spend the day outside and to give something back to a place they love. Others leave a nearby classroom in Inverness or Bolinas and gain a practical, hands-on science lesson while gathering data for resource managers. Through their effort and dedication, Point Reyes receives valuable information about harbor seal and elephant seal populations, rare plants, and other species. Interns work with the northern spotted owl monitoring their numbers, their nesting productivity and behavior. Others monitor intertidal zones counting diversity and distribution of species found clinging to the rocks in areas exposed only in extremely low tides.

Northern spotted owl, NPS Collection



Bishop pine, NPS Collection

Park partners are also integral to the inventory and monitoring studies at Point Reyes. In situations where specialized experience is required or there is an overlap with other studies already being conducted, Point Reyes relies on its partners. The Seashore has developed strong partnerships with the Point Reyes Bird Observatory, the Audubon Society, the California Native Plant Society, colleges and universities, the Fish and Wildlife Service, and the Gulf of the Farallones National Marine Sanctuary. Through these partnerships, Point Reyes has gained incredible amounts of scientific information regarding mammal, amphibian, and bird populations. Through a partnership with the USGS Biological Resources Division we have documented mountain lions, black-tailed weasels, bobcats, raptors, and other notable wildlife using trail cameras at monitoring arrays.

Common murres, NPS Collection

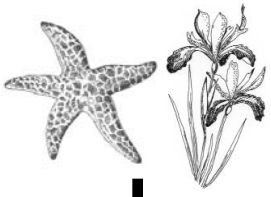
Even with volunteers and partners, there is no way to monitor all of the 900 plus species of plants, the 480 species of birds, and over 100 different species of land vertebrates. So the big question is where to focus our limited resources? The answer is where the most can be gained, where the most can be lost, and where the most attention is focused.

Elephant seal, Point Reyes, NPS Collection

At Point Reyes, inventory and monitoring efforts are concentrated in four main areas. We monitor federally threatened and endangered species like the northern spotted owls. These species are closely monitored and actively studied to protect the Point Reyes population from disturbance and decline. We also pay close attention to keystone species, such as Bishop pines and wood rats, on which total ecosystem health is hinged. Because a disruption in a keystone species can often be felt throughout an entire ecosystem, it is crucial that we understand their population dynamics. Sensitive species, like the common murres, are the third type of species that is monitored carefully. They are often the most vulnerable to changes in an ecosystem and therefore are good indicators of larger problems in the environment. Lastly, heroic species, such as the tule elk and elephant seals, are monitored. Tule elk and elephant seals capture our hearts and our minds and focus our attention on their survival for the freedom and wildness that they embody.

By focusing our efforts and working with volunteers and partners, there is more scientific work being done today at Point Reyes than ever before. We are gaining a strong base of scientific knowledge to guide management decisions within the Seashore. But there is still more to do than there are staff, volunteers, and partners. So what's the solution? It could very well be you, and some of your time. Your commitment to Point Reyes National Seashore can ensure that Point Reyes will not only remain beautiful, but healthy and full of diversity for years to come.

What Flora and Fauna Can We Expect to See on Our Field Trip?



Students will assume the roles of botanists and biologists while gaining familiarity with field guides and other research sources. All students will identify and research common wildlife and plant species found at Point Reyes National Seashore.

Time required: 2 hours
Location: classroom
Suggested group size: entire class

Subject(s): art, science, English
Concept(s) covered: natural history, ecological principles

Written by: Steve Anastasia and Beth Brindle, National Park Service
Last updated: 09/19/00

Student Outcomes

At the end of this activity, students will be able to:

- Prepare for the upcoming field trip.
- Effectively locate and record information gained through research.
- Identify common species found at Point Reyes National Seashore.

California Science Standard Links (grades 6–8)

This activity is linked to the California Science Standards in the following areas:

6th grade
- 5a- food webs
- 5b- organisms and the physical environment
- 5c- organisms can be categorized by the functions they serve in an ecosystem
- 5d- different organisms may play similar ecological roles in similar biomes
- 5e- organisms an ecosystem can support depends on resources available
- 7b- use appropriate tools/technology to perform tests, collect/display data
- 7d- communicate the steps and results from an investigation

7th grade
- 7a- use appropriate tools/technology to perform tests, collect/display data
- 7b- utilize a variety of print and electronic resources
- 7e- communicate the steps and results from an investigation

Pre-Visit Lesson Plan

National Science Standard Links (grades 5-8)

This activity is linked to the National Science Standards in the following areas:

- Content Standard A – Identify questions that can be answered through scientific investigations; Use appropriate tools and techniques to gather, analyze, and interpret data.
- Content Standard C – Structure and function in living systems; Populations and ecosystems; Diversity and adaptations of organisms.
- Content Standard F – Populations, resources, and environments.

Materials

To be provided by the teacher:

- Research materials such as field guides, relevant books, access to the Internet

To be photocopied from this guide:

- **Animal Species**, and **Plant Species** Activity Sheets (one per species)
- Species lists for student research

Vocabulary

annual, biologist, botanist, bud arrangement, coastal scrub, coniferous, deciduous, decomposer, endangered, exotic, fauna, first order consumer, flora, habitat, perennial, producer, mixed woodland, native, riparian, scat, second order consumer, scavenger, shrub, sign, third order consumer, threatened

Procedures

1. Select one of the following locations to visit during your field trip to Point Reyes:
   - ❑ **Bear Valley Trail** = Douglas fir forest and riparian
   - ❑ **Bayview Trail to Muddy Hollow** = bishop pine forest, coastal scrub, and riparian
   - ❑ **Coast Trail** = coastal scrub and riparian (possibly sandy beach)
   - ❑ **Limantour Beach** (from big parking lot) = coastal scrub, estuary, and sandy beach

2. **Introduction**
   Have a discussion to learn about plants and animals.
   A. **Who studies plants and animals?**
      Botanists and biologists.
   B. **What are they trying to learn about?**
      Populations, their role in the ecosystem interrelationships with other species, behavior, distribution, how we affect the species.
   C. **Why do they want to know all these things?**
      The more that a species and its role in the ecosystem is understood, the more effectively it can be managed.

D. Why would a wild animal or plant need to be managed?

1) Humans are part of the ecosystem but have the power to significantly alter ecosystems.
2) Often in the past we have altered the ecosystems we live in only to find out that our actions have harmed wildlife and plant species.
3) By learning about plant and animal species we can try to prevent damage to ecosystems in the future and help to repair damage done in the past.
4) Some examples:

Salmon and dams
Peregrine falcons and DDT
Northern spotted owls and old growth forest loss
Sandhill cranes and loss of wetlands due to development

3. Activity

Students assume the role of botanists and biologists and research specific plants and animals found in a particular habitat. *(Research is one step in understanding an ecosystem)*

A. Instructions:

1) Students will break into teams (2–5 students). The teams will consist of both botanists and biologists.
2) Using the species list for a particular habitat, give each student team a list of the plants and animal species that they will independently research. *(See appropriate Teacher Information "Species List".)*
3) Student teams will need a copy of the plant and animal activity sheets for each of the plant and animals they research.
4) Students can use field guides, other books, or the Internet to complete their research sheets (this can be done in class or as homework). See Resources at end of guide.

B. Some explanation may be needed to explain the use of field guides, indexes, etc.

4. Discussion

A. Have each group pick one of the researched plants or animals and present its findings to the class. This includes any important identifying characteristics, its role in the ecosystem (producer, consumer, decomposer, or scavenger) and why they chose this animal or plant to present.

B. Wrap-up

1) Review what has been learned.
2) How to use a field guide.
3) Plants and animals found in a specific habitat.
4) Tie lesson to on-site visit "What Flora and Fauna Can We Observe at Point Reyes?"
5) Research is one part of understanding an ecosystem but is not the only one. When we visit Point Reyes National Seashore, we will be performing field observations to further gain understanding of our studied ecosystem.

C. To aid in field observations, compile completed animal and plant identification sheets into "Guide Book" for use at Point Reyes.

Extension Activities

1. Research one of the following topics including what restoration efforts have taken place or are currently being implemented:
   A. Salmon and dams
   B. American peregrine falcons and DDT
   C. Northern spotted owl or marbled murrelet and old growth forest loss
   D. Greater sandhill crane and loss of wetland habitat due to development
   E. Common murres and the Apex oil spill (offshore San Francisco)
   F. Nonnative species removal in the San Francisco Bay
   G. California condor reintroduction efforts

   (A great source of background information on the above topics is found at ***www.fws.gov***.)
2. Research how someone becomes a botanist or a biologist and what each does.
3. Invite a botanist and/or biologist to your classroom to discuss their job.

Name _____ **Date** _____

Activity Sheet

Animal Species

(Amphibians, Reptiles, Fish, Mammals, and Birds)

Common name:

_____

Scientific name:

_____

Classification

Is this animal a (check one)

- ❑ Mammal
- ❑ Reptile
- ❑ Amphibian
- ❑ Fish
- ❑ Bird

Draw or include a picture of your animal.

Description

Size: _____ Weight: _____

Color: _____ Other important information: _____

_____

Range, Habitat and Niche

Range: _____

_____

_____

Habitat preference: _____

_____

_____

Circle below which niche your species fills in the food web.

producer	1st-order consumer	2nd-order consumer
3rd-order consumer	decomposer	scavenger

Activity Sheet

Name _____ **Date** _____

Animal Species

Life Cycle

At what age does this animal reach maturity? _____

Describe this animal's breeding behavior: _____

_____

_____

Food Chains

Who is (are) this animal's prey? _____ predator(s)? _____

How does it prevent itself from becoming prey? _____

_____

Sign

Sometimes you can identify animals from their "sign" without ever seeing the animal. What is this animal's sign? _____

_____

Draw two signs of this animal below.

Type of sign: _____ Type of sign: _____

Humans in Ecology

Is this animal: (circle one)

endangered	threatened	sensitive	abundant

What are the causes of the designation above? _____

_____

_____

Are humans currently helping this species? How? _____

_____

_____

Name _____ **Date** _____

Activity Sheet

Plant Species

Common name: _____

Scientific name: _____

Draw a picture of your plant species.	Draw a picture of this species' leaf or needles.

Classification

Identify the type of plant: ❑ tree ❑ shrub ❑ flowerering plant

Is it deciduous or coniferous? _____

Is it annual or perennial? _____

What is the bud and leaf attachment?

❑ Alternate ❑ Opposite ❑ Whorled ❑ Fascicled

Why are these characteristics important? _____

_____

_____

Ecological Niche

List the conditions in which this species will thrive: _____

_____

_____

_____

Activity Sheet

Name _____ **Date** _____

Plant Species

Ecological Niche (continued)

What factors limit this species? _____

_____

_____

Does this species have any unique survival strategies? What are they?

_____

_____

_____

List an unusual or interesting fact about this plant.

_____

_____

_____

What other species rely on or are impacted by the presence of this plant?

_____

_____

Circle which niche your species fills in the food web. Circle one.

producer	1st-order consumer	2nd-order consumer
3rd order-consumer	decomposer	scavenger

Humans in Ecology

This plant is classified as: (mark one)

❑ endangered ❑ threatened ❑ sensitive ❑ abundant

Is it native or exotic to Point Reyes? If it is exotic, how and why was it introduced at Point Reyes? _____

_____

_____

Has this plant been used for human consumption? If so, how?

_____

_____

Identifying Plants and Animals in the Field

When you don't know what kind of plant or animal you are observing, try to remember important characterisitics that will help identify the species in a field guide.

Bird:

Where is it located? What habitat are you in?
What shape is the beak?
What colors are the feathers?
What is it doing?
What is its flight pattern?

Mammal:

Where is it located? What habitat are you in?
What color(s) is the fur?
What is it doing?
How big is it?
Does it have any unique features? (antlers, big ears, short tail . . .)

Plant:

Where is it located? What habitat are you in?
What shape are the leaves?
What is the leaf arrangement?
How big is it?
Does it have any unique features? (stem shape, bark, color, flowers, cones, fruits . . .)

Amphibian:

Where is it located? What habitat are you in?
Is it a frog, toad, or salamander?
What color(s) is it?
What shape is its head and body?

Reptile:

Where is it located? What habitat are you in?
Is it a lizard, snake, skink, or turtle?
What color(s) is it?
What shape is its head and body?

Invertebrate:

Where is it located? What habitat are you in?
Is it an insect, shellfish, starfish, worm, or sponge?

Coastal Scrub Species List

Native plants

- ❑ Cow parsnip
- ❑ Bush lupine
- ❑ Coyote bush
- ❑ Ceanothus
- ❑ California poppy
- ❑ Indian paintbrush
- ❑ Douglas iris
- ❑ Poison oak
- ❑ Huckleberry
- ❑ Bush monkey flower

Native amphibians/reptiles

- ❑ Red-sided garter snake
- ❑ Banana slug
- ❑ Pacific tree frog

Birds

- ❑ Anna's hummingbird
- ❑ California quail
- ❑ Turkey vulture
- ❑ Red-tailed hawk
- ❑ American kestrel
- ❑ Northern harrier

Mammals

- ❑ Coyote
- ❑ Spotted skunk
- ❑ Black-tailed deer (mule deer)
- ❑ Tule elk
- ❑ Mountain lion
- ❑ Pocket gopher
- ❑ Bush rabbit
- ❑ Gray fox
- ❑ Bobcat
- ❑ Deer mouse
- ❑ Raccoon

Native Plants

- ❑ Coast live oak
- ❑ California coffeeberry
- ❑ Red elderberry
- ❑ California bay
- ❑ Douglas fir
- ❑ Thimbleberry
- ❑ Poison oak
- ❑ Old-man's beard
- ❑ Hazelnut
- ❑ Tan oak
- ❑ Ceanothus
- ❑ Bishop pine
- ❑ California hazelnut
- ❑ Bay laurel
- ❑ Madrone
- ❑ California buckeye
- ❑ Manzanita
- ❑ Huckleberry

Native amphibians/reptiles

- ❑ California newt
- ❑ Banana slug
- ❑ Terrestrial garter snake

Birds

- ❑ California quail
- ❑ Acorn woodpecker
- ❑ Turkey vulture
- ❑ Steller's jay

Mammals

- ❑ Wood rat
- ❑ Black-tailed deer
- ❑ Mountain lion
- ❑ Striped skunk
- ❑ Western gray squirrel

Riparian Species List

Native Plants

- ❑ Miner's lettuce
- ❑ Horsetail
- ❑ Stinging nettle
- ❑ Yellow willow
- ❑ Red alder
- ❑ Blackberry

Native amphibians/reptiles

- ❑ California red-legged frog
- ❑ Rough-skinned newt
- ❑ Aquatic garter snake
- ❑ Pacific tree frog
- ❑ Salamander

Mammals

- ❑ Raccoon
- ❑ Black-tailed deer

Fish

- ❑ Coho salmon
- ❑ Steelhead trout

Invertebrates

- ❑ Banana slug

Birds

- ❑ Olive-sided flycatcher
- ❑ Wilson's warbler
- ❑ Red-shouldered hawk
- ❑ Northern harrier
- ❑ Great-horned owl
- ❑ Northern spotted owl

Estuary Community Species List

Birds

- ❑ Snowy egret
- ❑ Great blue heron
- ❑ Mallard
- ❑ Green-winged teal
- ❑ Northern shoveler
- ❑ Marbled godwit
- ❑ Willet
- ❑ Osprey
- ❑ Black brant
- ❑ Pied-billed or Western Grebe
- ❑ Surf or White-winged Scoter

Native Plants

- ❑ Eelgrass
- ❑ Cordgrass
- ❑ Pickleweed
- ❑ Salt grass

Marine Invertebrates

- ❑ Washington clam
- ❑ White sand clam
- ❑ Shrimp
- ❑ Fat innkeeper
- ❑ Geoduck
- ❑ Nudibranch
- ❑ Hydroid
- ❑ Sponge
- ❑ Tunicate
- ❑ Feather-duster worm
- ❑ Red scale worm
- ❑ Pea crab
- ❑ Oregon shore crab
- ❑ Gaper clam
- ❑ Channeled basket whelk
- ❑ Tall-spired horn snail

Fish

- ❑ Goby fish
- ❑ Bat ray
- ❑ Leopard shark
- ❑ Rubberlips
- ❑ Topsmelt
- ❑ Pacific herring
- ❑ Coho salmon
- ❑ Flounder

Mammals

- ❑ Harbor seal
- ❑ Raccoon

Sandy Beach/Dune Community Species List

Birds

- ❑ Snowy plover
- ❑ Black-bellied plover
- ❑ Marbled godwit
- ❑ Willet
- ❑ Heermann's gull
- ❑ Ring-billed gull
- ❑ Western gull
- ❑ Brown pelican
- ❑ Sanderling
- ❑ Turkey vulture
- ❑ Raven

Marine Invertebrates

- ❑ "Beach hopper" amphipod
- ❑ Sand crab (mole crab)
- ❑ *Velella velella* (by the wind sailor)
- ❑ Sand dollar
- ❑ Shore crab

Plants

- ❑ American dune grass
- ❑ Sand verbena
- ❑ Saltbush
- ❑ Douglas bluegrass
- ❑ Beach strawberry
- ❑ Dune lupine
- ❑ Beach morning glory

Mammals

- ❑ Striped Skunk
- ❑ Gray Fox
- ❑ Raccoon

Tide Pool Community Species List

Marine Invertebrates

- ❑ Anemone
- ❑ Nudibranch
- ❑ Chiton
- ❑ Red abalone
- ❑ Limpet
- ❑ Sea star
- ❑ Hermit crab
- ❑ Barnacle
- ❑ Goose barnacle

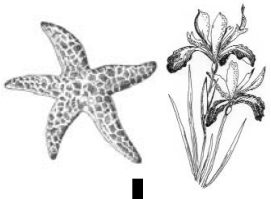
Fish

- ❑ Opaleye

Marine Plants

- ❑ Turkish towel (red algae)
- ❑ Sea lettuce (green algae)
- ❑ Eelgrass
- ❑ Surfgrass
- ❑ Sea palm

How Can We Prepare for Our Visit to Point Reyes National Seashore?



Students will prepare for the upcoming field trip by constructing field journals and reviewing personal field trip expectations.

Time required: 1 hour
Location: classroom
Suggested group size: entire class

Subject(s): science, math, writing
Concept(s) covered: field observations and data collection

Written by: Christie Denzel Anastasia, National Park Service
Last updated: 10/09/00

Student Outcomes:

At the end of this activity, students will be able to:

- Utilize field journals while observing habitats at Point Reyes National Seashore.

California Science Standards Links (grades 6–8)

This activity is linked to the California Science Standards in the following areas:

6th grade 7b- use appropriate tools/technology to perform tests, collect/display data
7th grade 7a- use appropriate tools/technology to perform tests, collect/display data
8th grade 9a- plan and conduct a scientific investigation to test a hypothesis

National Science Standard Links (grades 5–8)

This activity is linked to the National Science Standards in the following areas:

- Content Standard A - Use appropriate tools and techniques to gather, analyze, and interpret data; Understanding about scientific inquiry.
- Content Standard G - Science as a human endeavor

Materials

To be photocopied from this guide:

- Field Journal Sheets for each student, teacher, and chaperone (located in first onsite lesson plan)
- Vocabulary sheets (located in Attachments of Teachers Preparation)

Pre-Visit Lesson Plan

Procedures

1. **Preview Field Trip Logistics**

   See the on-site journal activity instructions for **What Flora and Fauna can we observe at Point Reyes?**

2. **Have the students construct their Field Journals**

   A. See the attached sheet for "Tips for Constructing Field Journals".
   B. Hand out photocopies of the Journal Sheets and the vocabulary list. If you are not visiting the beach habitats, then omit the field journal sheets that have only starfish in the upper corner and use only the land habitat vocabulary list (with the Douglas Iris in the corner).
   C. Have students assemble their field journals.

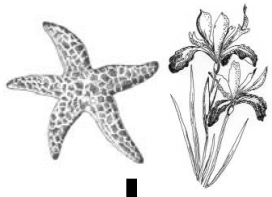
3. **Review field activities by having students turn to appropriate page in their journal as you review expectations:**

   - **Things to Remember While on the Habitats Field Trip**
     Students will complete this sheet at the end of the next lesson, "Safety and Stewardship Challenge".
   - **Three Things to Watch Out For . . . and How to Avoid Them!**
     Review this information with students for a safe field trip.
   - **Bear Valley Visitor Center Activity Sheets**
     Students will answer questions on these sheets while inside the Bear Valley Visitor Center. Some questions require students to label their answers on a map. The "Annual Precipitation" sheet provides information to answer one of the questions.
   - **Field Observation Sheets**
     Once students are given a place to sit on the trail, each of the following sheets will need to be filled out to the best of a student's ability:
   - **Habitat Information**
     Students use their powers of observation to complete the information requested.
   - **Habitat Key**
     Student information sheet that will provide answers to some of the questions on the "Habitat Information" journal sheet.
   - **Using Leaves to Identify Plants/ Layers of Forest Life**
     Student Information sheet that will provide answers to some of the questions on "Plant Observations" journal sheet.
   - **Identifying Plants and Animals in the Field**
     Student Information sheet that will provide answers to some of the questions on "Wildlife Observations" journal sheet.
   - **Plant Observations/ Wildlife Observations/ Seashore Observations**
     Students use their powers of observation to complete the information requested.

4. **Additional Sheets**
   - **Species List by Habitat Type**
     These student information sheets list some of the most common or likely to be seen species in the Seashore.
   - **Vocabulary Sheets**
     Include vocabulary sheets from the Attachments section of Teacher Preparation in students' journals. If students are unsure of a word listed their field journals, these sheets will provide a definition.
5. **Review what students should bring on the field trip**
   (see the chart in the Teacher Preparation unit)

Extension ideas

1. Have students assume the role of aliens coming to study humans and their pets. What type of field journal would they need? What key characteristics would they use? How would they observe without altering the behavior of their subjects or scaring them away?
2. Research other laws written to protect mammals, plants, and amphibians in Point Reyes National Seashore, California, and the United States. Visit the environmental law web site at www.habitat-restoration.com/laws.htm
3. What happens if a protected animal leaves the area affording protection?
4. Research the role of marine biology and other types of studies conducted. What is done with information collected in the field, and how does it help the organism being studied?



Tips for Creating Field Journals

Materials

- ❏ Field Journal Sheets for each student, teacher, and chaperone
- ❏ One package blank paper and one package lined paper
- ❏ colored paper, card stock, or cardboard for journal covers
- ❏ magic markers or colored pencils for decorating covers
- ❏ 3-hole punch
- ❏ string, binding tape, or twigs and rubber bands for binding
- ❏ pencil on a string for each student
- ❏ two plastic pencil sharpeners and extra pencils for field trip
- ❏ one box of large ziplock bags to rainproof journals

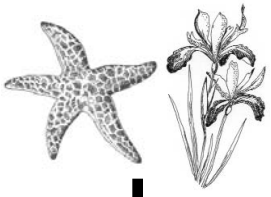
Procedures

1. Photocopy all of the unit handouts and provide each student with double-sided copies. Use recycled paper if it is available.
2. Provide five additional blank sheets of paper and five lined sheets of paper to each student.
3. Have students create front and back covers for their journals using blank sheets of paper.
4. Have students bind their journals using binding tape, hole punches and string, cardboard, or twigs bound by rubber bands threaded through holes. If they do not bind their journals, it is essential that students use a clipboard on the field trip.
5. Once journals are bound, have them decorate the covers.
6. Have each student attach a sharpened pencil on a long string through a hole in the journal binding.
7. Have students use magic markers to write their names on the front covers of their journals.
8. Students will need a sturdy writing surface behind their field journals. Incorporate cardboard as the last page or have clipboards available for each student.

Extension ideas

1. Create a journal that is used throughout the year.
2. Share student journals with parents at open houses and/or to educate others.
3. Students may choose to use their journals to create a class newsletter, resource newspaper, or a class website.

Safety and Stewardship Challenge



Students will learn methods for observing flora and fauna and understand proper behaviors in a National Park. This will be accomplished by simulating a group "game show" and completing the first page of their field journals.

Time required: half an hour or more (depending on predetermined limits)
Location: classroom
Suggested group size: any

Subject(s): science
Concept(s) covered: low impact use of natural areas, visitor behaviors in a National Park, safety

Written by: Christie Denzel Anastasia and Lynne Dominy, National Park Service
Last updated: 09/21/00

Student Outcomes

At the end of this activity, students will be able to:

- List three safety precautions for the upcoming field trip.
- List three proper behaviors for observing wildlife.
- Understand concepts of the National Park System and stewardship.

National Science Standard Links (grades 5-8)

This activity is linked to the National Science Standards in the following areas:

- Content Standard F–Personal Health: Injury Prevention; Populations, resources, and environment

Materials

To be provided by the teacher:

- Desk bell (or other device to indicate which team has the first answer)

To be photocopied from this guide:

- "Safety and Stewardship Challenge Questions" (one set)

Vocabulary

stewardship

Pre-Visit Lesson Plan

Procedures

1. Divide class into teams

Option A: If the class can work in large teams, divide the class in half. Each team will need a spokesperson and team name. Answers will come from the entire team and the spokesperson can change throughout the game.

Option B: If the class gets too loud, students can still be divided into teams, but answers will come from individuals on each team. One person from each team will be assigned a number. Team A and Team B will each have a #1, #2, etc. Students randomly choose a number from hat. The student with that specific number from each team will be responsible for answering the question. Random choice of numbers will help students pay attention if they aren't quite sure when their turn will occur.

2. Draw challenge grid and scorecard on blackboard

There are four categories with questions of varying value. As a finale, there is a final challenge question. Draw this grid on the chalkboard:

<table>
<tr><td colspan="4">Safety and Stewardship Challenge</td></tr>
<tr><td>Category #1
Take Care of Yourself</td><td>Category #2
Minimize Your Impact</td><td>Category #3
Habitat Etiquette</td><td>Category #4
The National Park Service</td></tr>
<tr><td>1 point</td><td>1 point</td><td>1 point</td><td>1 point</td></tr>
<tr><td>2 points</td><td rowspan="2">2 points</td><td>2 points</td><td rowspan="2">2 points</td></tr>
<tr><td>3 points</td><td>3 points</td></tr>
<tr><td rowspan="2">4 points</td><td rowspan="2">3 points</td><td>4 points</td><td rowspan="2">3 points</td></tr>
<tr><td>5 points</td></tr>
<tr><td colspan="4">Final Challenge</td></tr>
</table>

3. Choose challenge hosts

Option A: Teacher is responsible for asking all of the questions.

Option B: Four students will become "Challenge Hosts". Each student receives questions for a specific category and will ask appropriate questions according to point value.

4. **Rules of the game**
   - A coin flip will determine which team goes first.
   - The game will end when a predetermined time runs out or when all questions have been answered.
   - Team will decide which category and value of question will be asked.
   - Spokespersons or individuals will poise themselves on either side of the desk bell with one hand behind their back.
   - After the question is asked, the first team to have an answer will ring the bell and respond. If they are correct, the team receives the full point value.
   - If they are incorrect, the other team gets a chance. If they also get it wrong, the first team can try again for one less point.
   - When brainstorming answers, students should whisper (or the other team may hear their answer).
   - When all of the categories are complete (or 5 minutes before a predetermined "game over" time), class will go into "Final Challenge". Each team decides on the amount to wager, listens to the question and writes down the answer on a sheet of paper. Each team reveals their answer.
   - At the end of the game, the team with the most points "wins", but everyone wins if their visit to Point Reyes National Seashore is safe for themselves and the resources.
5. **Complete first page of field journal**

   Using the information gained in this "game show", have students list at least three items under each category on the first page of their journal ("Things to Remember While on the Habitat Field Trip"). Use the "Safety Issues: Habitat Unit" at the end of this lesson as a guide.

Safety and Stewardship Challenge Questions

Teacher Master

CATEGORY #1: Take Care of Yourself

1 point

Bring a water bottle and drink plenty of water because . . .

A . . . you will not be able to speak well with a dry throat.

B **. . . not drinking enough water can give you a headache and cause you to make bad decisions.**

C . . . a heavy water bottle will slow you down as you are walking.

D All of the above.

2 points

If the sun feels warm, you should . . .

A . . . try to get a tan.

B **. . . use sunglasses, sunscreen, and/or a hat.**

C . . . take off your shoes and walk barefoot.

D All of the above.

3 points

Cliff edges in Point Reyes National Seashore are . . .

A . . . made of granite and are safe as long as you have one foot flat on the ground at all times.

B **. . . sandy, loose, and slippery; be careful at all times.**

C . . . safe if you have good balance.

D . . . the best places for a good view.

4 points

The best way to dress for a field trip:

A comfortable closed-toed shoes.

B a t-shirt and a heavy, waterproof jacket.

C "like an onion", many thin layers with a waterproof one on the outside.

D **A and C.**

Teacher Master

Safety and Stewardship Challenge Questions

CATEGORY #2: Minimize Your Impact

1 point

When visiting Point Reyes National Seashore, you should stay on trails because . . .

A . . . you are more likely to pick up a tick in grassy areas.

B . . . you can damage plants.

C . . . when you travel off-trail you are speeding up erosion.

D **All of the above.**

2 points

It's okay to take home just one rock from Point Reyes National Seashore.

A Sure, it's just one, but let your teacher know.

B No, every rock is home to many bugs and plants.

C No, with 2.5 million visitors, the Seashore would be rock-less if every visitor collected just one.

D **B and C.**

3 points

Trash is . . .

A . . . okay to hide behind bushes in a National Park because it will eventually break down.

B . . . not a good source of food for hungry animals.

C **. . . not a part of the Point Reyes National Seashore ecosystem and should be properly disposed of whether it's your trash, or trash that someone else has left behind.**

D . . . only the responsibility of the maintenance staff, wherever it is.

Safety and Stewardship Challenge Questions

Teacher Master

CATEGORY #3: Habitat Etiquette

1 point

To avoid getting exposed to poison oak, stinging nettle, and ticks in the park, you should . . .

A . . . know what stinging nettle and poison oak look like before touching plants.

B . . . stay on the trails.

C . . . wear light colored clothes and check them regularly for ticks.

D **All of the above.**

2 points

If you see a rattlesnake or mountain lion, you should . . .

A . . . pet it.

B . . . scream and run to the nearest tree.

C . . . **slowly back away and avoid any startling behaviors.**

D . . . get as close as you want.

3 points

The best way to observe wildlife is to:

A have patience.

B stay in one place for a while being as quiet as possible.

C pay attention.

D **all of the above.**

4 points

Feeding wildlife will . . .

A . . . be okay, because it is legal.

B . . . put you in danger of a bite or an attack.

C . . . accustom them to humans and possibly create behaviors harmful to the animal's survival.

D **B & C above.**

5 points

If you come across wildlife appearing sick or injured, you should:

A . . . try to capture the animal and seek medical attention.

B . . . **report the location, species, and your observations to someone who is responsible for its management (Park Rangers in National Parks, Humane Society in urban areas).**

C . . . leave it alone.

D . . . take it to the emergency room.

Teacher Master

Safety and Stewardship Challenge Questions

CATEGORY #4: The National Park Service

1 point

Which of the following is not in the National Park Service?

A Grand Canyon National Park, AZ.

B Keweenaw National Historical Park, MI.

C **Monterey Bay Aquarium, CA.**

D Golden Gate National Recreation Area, CA.

E Yosemite National Park, CA.

2 points

I should treat Point Reyes National Seashore with respect because . . .

A . . . it belongs to everyone in the entire United States.

B . . . it preserves a part of the ecosystem you live in and depend on.

C . . . it's one of the few places natural processes can happen with little intervention from human society.

D **All of the above.**

3 points

Which of the following is the mission of the National Park Service?

A preserve natural and cultural resources.

B provide for the enjoyment, education, and inspiration of this generation.

C to care for special places saved by the American people so that all may experience our heritage.

D cooperate with other resource-conservation and outdoor-recreation organizations in our country and the world.

E **All of the above.**

Teacher Master

Bonus for one additional point:

Is the mission of the National Park Service a law? (Yes) No

Yes. The 1916 Organic Act mandates the National Park Service to preserve and protect the natural and cultural heritage of the United States for the enjoyment of its citizens, leaving them unimpaired for the enjoyment of future generations.

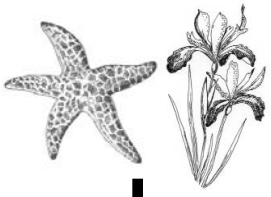
FINAL CHALLENGE

This question is worth the amount that each team agrees to wager.

What does stewardship mean?

Teacher is the final judge on this answer.

Safety Issues: Habitat Unit



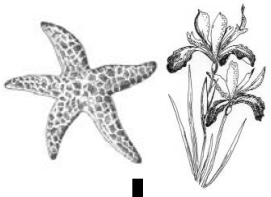
Personal Safety

- Watch where you are walking; the ground may be rocky and uneven.
- Stay with your group.
- Drink plenty of water to avoid dehydration.
- Protect yourself from the sun's rays; use sunscreen and/or a hat.
- Stay on paths and in picnic areas. Grassy areas may have ticks that are known to transmit Lymes' disease.
- Be aware of personal allergies or conditions that may cause concern on the trail.
- Follow all directions and observe posted signs.
- Watch out for poison oak and stinging nettle.

Remember, you are in a part of the National Park System.

- Point Reyes National Seashore is a natural area set aside to protect living and nonliving components of an ecosystem. Treat everything with respect.
- Allow plants and rocks and everything to continue their existence as part of an ecosystem by leaving things as they are found.
- Stay on established trails.
- Pack out trash or use garbage cans.
- Enjoy your visit and know this is your National Seashore!
- Think about what makes Point Reyes National Seashore worth preserving and how you can help.

How Do I Use Binoculars?



Students prepare for upcoming field trip by becoming familiar with binocular structure and use. Being able to clearly see parts of each habitat will greatly increase the success of your field trip.

Time required: 30 minutes
Location: in class and/or sections at Bear Valley Visitor Center
Suggested group size: entire class

Subject(s): physics
Concept(s) covered: binocular structure and use

Written by: Christie Denzel Anastasia, National Park Service
Last updated: 09/31/00

Student Outcomes

At the end of this activity, students will be able to:

- Understand the structure of binoculars.
- Practice focusing on moving images with binoculars.

California Science Standard Links (grades 6–8)

This activity is linked to the California Science Standards in the following areas:

6th grade 7b- use appropriate tools/technology to perform tests, collect/display data

7th grade 6b- to see an object, light emitted/scattered must enter eyes
6d- simple lenses used in optics
7a- use appropriate tools/technology to perform tests, collect/display data

National Science Standard Links (grades 5–8)

This activity is linked to the National Science Standards in the following areas:

- Content Standard A – Abilities necessary to do scientific inquiry: Use appropriate tools and techniques to gather, analyze, and interpret data.

Materials

To be provided by the teacher:

- Perhaps one pair of binoculars

Procedures

Note: This lesson can be done in various stages depending on whether or not students have access to binoculars in class.

If students can ***bring in a pair*** of binoculars to use in class:

This entire lesson can be conducted in class.

If students can ***share a pair*** of binoculars to use in class:

Procedure 1 and 2 can be taught to entire class. Student teams can experiment with binoculars in 10-minute intervals throughout day.

If students ***do not have access*** to binoculars:

Procedures 1 and 2 can be conducted in class, Procedure 3 at Bear Valley Visitor Center when students receive individual binoculars from the Habitat Kit.

1. **How do binoculars work?**
(There are numerous websites on binocular structure for more information.)

Brief summary:

In Theory: Before prisms were available, lens barrels had to be very long to increase the distance between eyepiece lens and objective lens to achieve magnification. These are the traditional "pirate scopes". With the introduction of prisms, the light can be bent and barrels made shorter. Binocular vision allows two images to become one for depth perception. Monoculars are like binoculars, but made for one eye and have no depth perception.

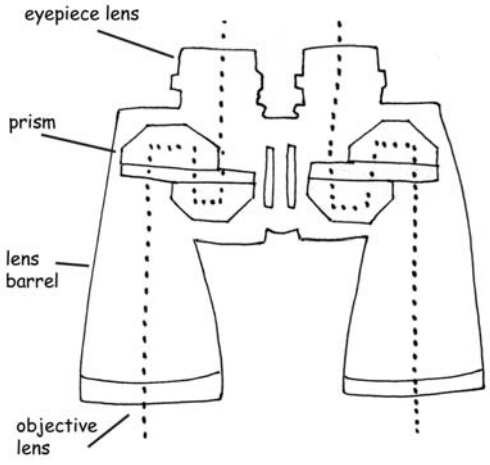
In Structure: There are four main components of binoculars. Power is a function of these components. A 6 x 30 binocular has 6x magnification and a 30-millimeter lens. A larger lens lets in more light.

Eyepiece Lens: there are several convex lenses here for magnification. This is the lens closest to your eyes.

Prism: Bends light rays and returns reverse image to normal.

Lens Barrel: Keeps distance between eyepiece lens and objective lens. Keeps out side lighting and dirt.

Objective lens: Gathers light in a convex lens. This is the lens that has a millimeter measurement (i.e., 6 x 30).



2. **How do I get binoculars to work specifically for me?**

Taking care of binoculars:

- Always keep them attached around your neck so they aren't accidentally dropped.
- While you are focusing binoculars, stand still. It would be easy to fall while focusing and walking.
- Clean binoculars properly.

If you wear eyeglasses:

- Keep your eyeglasses on.
- There is usually an "eye cup" rubber piece that folds back where your eyeglasses meet the eyepiece lens.

Things you adjust once:

- Barrel distance: The two barrels can be moved closer or further apart depending on the distance between your eyes.
- Focus right eyepiece: There is a knob on the right eyepiece that corrects for visual differences between your two eyes. If you are seeing more than one image, adjust the right eyepiece until there is one image.

Things you need to adjust with each observation:

- Center focus: Adjust the center focus with each observation to bring image into view.

Focusing on an image:

- Adjust barrel distance and right eyepiece.
- Locate the image with your eyes. Are there any landmarks or reference points next to the image? These references may help you find the image again with binoculars near your eyes.
- Focus your eyes on the image. Without looking down, place the binoculars directly in front of your eyes. The rubber cup surrounding the eyepiece lens should rest against your eyebrow (unless you are wearing eyeglasses).
- Focus image into view with center focus.
- Keep elbows tucked in close to body and both hands on binoculars to avoid a shaky image.

3. **Practice using binoculars.**

Focus on stationary object.

- Pick an object that doesn't move. Choose one somewhat near and one somewhat far. Use center focus.

Focus on moving objects in class.

- Right/left: Have a student walk slowly across class while students keep in view. Speed up student walker to add a challenge.
- Away/toward: Choose a student to move toward and away from binoculars. Discuss range that binoculars will work. At some point, the object is too close to focus.

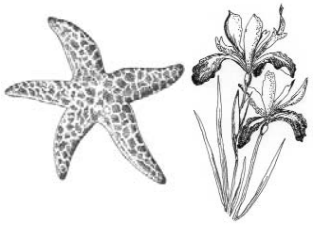
Focus on multiple moving objects at school.

- Attend a sporting event or practice at a lunch session in cafeteria.
- Place a wildlife poster on a piece of cardboard and stick. Have a student move around classroom with poster board: slow, fast, up, down, toward, away.

Focus on wildlife.

- Bring class outside in an area where they are likely to view moving wildlife such as birds.

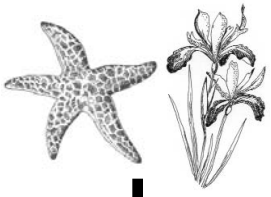
Creating
Coastal Stewardship
through Science



Defining Habitats

On-Site Activities

How Can We Understand the Habitats of Point Reyes National Seashore?



Using the Bear Valley Visitor Center exhibits and Field Journal Sheets, students will identify five different habitat types found at Point Reyes National Seashore. They will also examine the known environmental and geological factors that determine where they are located. After the Bear Valley Visitor Center activity, students will use field observation and data collection to identify specific flora and fauna that depend on these habitats.

Time required: 3 hours
Location: Bear Valley Visitor Center and selected habitat type
Suggested group size: entire class

Subject(s): science, art, English
Concept(s) covered: ecological principles and studies, the influences of environmental and abiotic factors on habitats

Written by: Steve Anastasia, Christie Denzel Anastasia, and Lynne Dominy, National Park Service
Last updated: 10/09/00

Student Outcomes

At the end of this activity, students will be able to:

- Explain what factors influence habitat.
- Name three different types of habitat.
- Locate where these habitats occur in Point Reyes National Seashore.
- Observe and identify plants and animals using key characteristics and field guides in selected habitats.

California Science Standard Links (grades 6-8)

This activity is linked to the California Science Standards in the following areas:

6th grade
- 2a- water running downhill is a dominant process on the landscape
- 2b- rivers and streams are dynamic systems
- 2c- beaches are dynamic systems in which sand is supplied by rivers
- 2d- earthquakes, landslides, and floods change human and wildlife habitats

On-site Activity

Creating Coastal Stewardship through Science

4e- differences in elements such as pressure may result in changes in weather
5a- food webs
5b- organisms and the physical environment
5c- organisms can be categorized by functions they serve in an ecosystem
5e- resources available and abiotic factors
7b- use appropriate tools/technology to perform tests, collect/display data
7c- develop qualitative statements about the relationships between variables
7e- evidence is consistent with a proposed explanation
7f- interpret a simple scale map
7h- identify changes in natural phenomena over time

7th grade
5a- plants and animals have levels of organization for structure and function
7a- use appropriate tools/technology to perform tests, collect/display data
7d- communicate logical connections

8th grade
9a- plan and conduct a scientific investigation to test a hypothesis
9b- evaluate the accuracy and reproducibility of data

National Science Standard Links (grades 5-8)

This activity is linked to the National Science Standards in the following areas:

- Content Standard A — Design and conduct a scientific investigation; Use appropriate tools and techniques to gather, analyze, and interpret data; Develop descriptions, explanations, predictions, and models using evidence; think critically and logically to make the relationships between evidence and explanations; Understanding about scientific inquiry.
- Content Standard C — Populations and ecosystems; Diversity and adaptations of organisms; Structure and function in living systems.
- Content Standard F — Personal health; Populations, resources, and environments; Natural hazards.

Materials

To be provided by the teacher:

- Pencils
- Clipboards
- Two watches for keeping track of time
- The compiled guide book from the pre-visit activity **What Flora and Fauna Can We Expect to See on Our Field Trip?**

To be photocopied from this guide:

- Constructed field journals for each student, chaperone and teacher.

Available for checkout at Bear Valley Visitor Center or Clem Miller Environmental Education Center:

- Habitat Backpack

Vocabulary

animal sign, annual precipitation, amphibian, behavior, bird, community, crown, diameter, dominant, environmental factors, erosion, fish, geological factors, geology, habitat, hypothesis, International Biosphere, mammal, native, predator, prey, reptile, ridge, slope, species, topography, understory

Procedures

Note to Teachers: *This activity consists of two parts: the Bear Valley Visitor Center orientation activities and the field observation and identification activities in the habitat that you have chosen to visit for in-depth study.*

It is important to complete the Bear Valley Visitor Center orientation activities first and then to complete the field journal activities. (See "Teacher Preparation" for location considerations.)

Bear Valley Visitor Center Activity

Contact the Ranger at the information desk and request to use the auditorium for 15 minutes for the following discussion (or sit outside at the picnic tables located in the picnic area).

A. Have a discussion about habitats

1) ***What are habitats? What are communities? Why are they found where they are?*** Habitats are not randomly located. Plant communities and habitats are located only in the places where they can survive.
2) ***What causes this?*** Plants have their own requirements for growth. The combination of environmental and geologic factors determines where plants can grow.
3) ***What are the environmental factors?*** Rain, wind exposure, and temperature all affect plant growth rates and where they can survive.
4) ***What are the geologic factors?*** Soil types and depth, their ability to hold moisture, their fertility as well as topography, also affect the placement of plant communities.

B. Explain the activity

1) Instruct the students to individually examine the exhibits carefully. These panels will help them complete the activity sheets.
2) Instruct students to treat the exhibits with care. Remind them not to handle the elements in the displays. Animals and plants are very fragile. Running and yelling are not permitted.
3) Designate a time limit for completing the activity sheets. Have the students regroup in the auditorium or in the picnic area. Twenty minutes should be appropriate.
4) Student should return to the auditorium when the teacher determines that the activity is finished.

5) Have the students use the exhibits to find the different types of communities found at Point Reyes National Seashore. Place the answers on the Activity Sheets. (All answers are found under the major community "banners".)

6) Using the maps and exhibits, students will then identify some of the environmental factors that determine habitats and hypothesize where different types of habitats will potentially be found. Their answers will be placed on the Bear Valley Field Journal Sheets.

Note to Teachers: *All the information needed for the activity is found on either the Activity Sheet or in the text of the exhibits. (The community exhibits are the most pertinent.)*

C. Return to Auditorium/Conclusion

1) Draw the activity to a close by discussing the results and what was learned. Summarize the geologic and environmental factors that influence habitats. Rainfall, the Inverness Ridge, types of soils, predominant winds from the northwest, the ocean's influence in both marine and land habitats have all combined to make Point Reyes unique, diverse and a national treasure.

2) What makes Point Reyes National Seashore so unique? (discussion)
- In approximately 100 square miles, 6 major types of communities exist.
- This equates into a great amount of diversity in a small area. There are over 480 species of birds, over 100 land vertebrates and 900 plus species of plants.
- The marine ecosystem off the coast of Point Reyes is one of the five most productive marine ecosystems in the entire world.
- For this reason, Point Reyes National Seashore and much of the surrounding state and federal land and ocean area was designated by the United Nations as an International Biosphere in 1988.
- Connect what was learned in this activity with the upcoming habitat field observations.

Field Observation Activity

1. Logistics

A. For all habitats, review from the field journal: "Things to Remember", "Things to Watch Out For", "Using Leaves to Identify Plants".
- For land habitats review "Layers of Forest Life".
- For seashore habitats review: "Intertidal Life Zo**nes**" on NP 6 of "Defining Habitats" newspaper.

B. Check out the habitat backpack from Bear Valley Visitor Center (Ed Center users pick it up at the Ed Center).

2. **Begin the activity**
   - **A.** Instruct all students to form a line with adults evenly spaced. Tell students that speaking in whispers and being quiet may allow them to see more wildlife. Tell students to look for patterns in plant distribution and to watch for wildlife while they walk.
   - **B.** When you have walked 5 to 10 minutes (depending on your time limitations), you will begin to place individual students or pairs of students at locations along the trail to do their field observations.
   - **C.** Before you place any students, place an adult with a watch first.
   - **D.** Then place pairs of students interspersed with adults. Place students approximately every 30 feet along the trail until all the students have been placed.
   - **E.** Students have 20 minutes to record data in their field journals. Adults should check with students to insure that they understand journal sheets and can proceed independently.
   - **F.** When the 20 minutes has elapsed, the adult that was placed first will walk up the trail and quietly collect all of the students.
   - **G.** When the entire group has reassembled, locate a place for a discussion. Students will now share the results from their observations and discuss their experiences.

3. **Concluding activity**
   - **A.** While students are walking back from the observation activity, identify the plants and animals that they have seen. This can be done by using the data they have collected, the identification cards found in the habitat backpack, and field guides or the guide book compiled by the students in the pre-visit activity **What Flora and Fauna Can We Expect to See on Our Field Trip?** Have the students mark the species that they have seen on their checklists.
   - **B.** When some or all of the plants and animals have been identified, draw conclusions from the two on-site activities and prepare students for the post-visit activities.

Bear Valley Visitor Center

Teacher Master

Your job is to discover how land and ocean communities interact with environmental factors such as wind, landscape, and rain. You will answer some questions and use the blank map titled "Write on This Map!" to understand the Point Reyes ecosystem. All of the answers are in the Bear Valley Visitor Center exhibits. Remember these are exhibits; treat them with respect.

Communities, Habitats, and Species

Use the Bear Valley Visitor Center exhibits to discover which land and ocean communities are found here. Also, list two resident species for each community.

Community	Two Resident Species
1. *Grassland/Coastal scrub*	*Black-tailed deer* *California quail*
2. *Open Ocean*	*Gray whales* *Elephant seals*
3. *Coast*	*Common murres* *Harbor seals*
4. *Forest*	*Mountain lions* *Northern spotted owls*
5. *Coastal wetlands*	*Great blue herons* *Western grebes*

Discovery Questions

One type of land community is divided into two subcommunities dominated by two different species of trees.

What community has two subcommunities?

forest community

What are the two subcommunities?

Bishop pine and Douglas fir

Teacher Master

Bear Valley Visitor Center

Why are bishop pines found here at Point Reyes?

They are found here because of the geology and soil type. The thin, infertile, rocky, granitic soils are the only place at Point Reyes where bishop pines can be found.

Find the Coastal Wetland Community display. Look to the left and find the panel that reads "Coastal Scrub". In which of the five community types does Coastal Scrub belong?

grassland

List five species that you would find in the Coastal Scrub community:

coyote, quail, turkey vulture, black-tailed deer, redtail hawk, marsh hawk, striped skunk, red-sided garter snake, jackrabbit, bobcat, badger

Map Activity

Using what you have learned in the exhibits, use "Write On This Map!" Journal Sheet to label where you would expect to find at least two of the five habitats that are found at Point Reyes National Seashore.

See Teacher Master for "Plant Communities at Point Reyes", page 97.

Environmental Factors

Use the relief map in the Bear Valley Visitor Center and the "Annual Precipitation" Field Journal sheet to discover how winds, landscape, and rain affect habitats.

Wind Factors

- Predominant winds at Point Reyes are from the west/northwest in the spring, summer, and sall.
- Wind speeds average between 25 and 40 miles per hour throughout the year. (The highest wind speed was recorded at the Lighthouse area at 133 miles per hour!)

Discovery Question

List three ways that high wind speeds can affect habitats, plants, or animals:

- ***can determine the amounts of moisture available to organisms***
- ***can limit plant height***
- ***can limit animals that depend on taller trees***
- ***can be a good habitat if it deters larger predators from the area***

Bear Valley Visitor Center

Teacher Master

Map Activity

Use arrows to label the northwest winds on the "Write On This Map!" Field Journal sheet.

See Teacher Master for "Write On This Map!", page 96.

Landscape Factors

- The Inverness Ridge is the backbone of the Point Reyes peninsula. Its height shelters the east side of Point Reyes from strong winds.

Map Activity

Check out the relief map near the entrance to Visitor Center. Locate and label the following on your map:

Inverness Ridge

Mount Wittenberg and its elevation

Tomales Bay

Drakes Bay

See Teacher Master for "Write On This Map!"

Rainfall Factors

- Study the map labeled "Annual Precipitation".

Question

What is the highest annual precipitation found at Point Reyes?

40 inches

Map Activity

Label which side of the Inverness Ridge gets most of the rainfall on your "Write On This Map!" Field Journal sheet.

eastern side of ridge
See Teacher Master for "Write On This Map!"

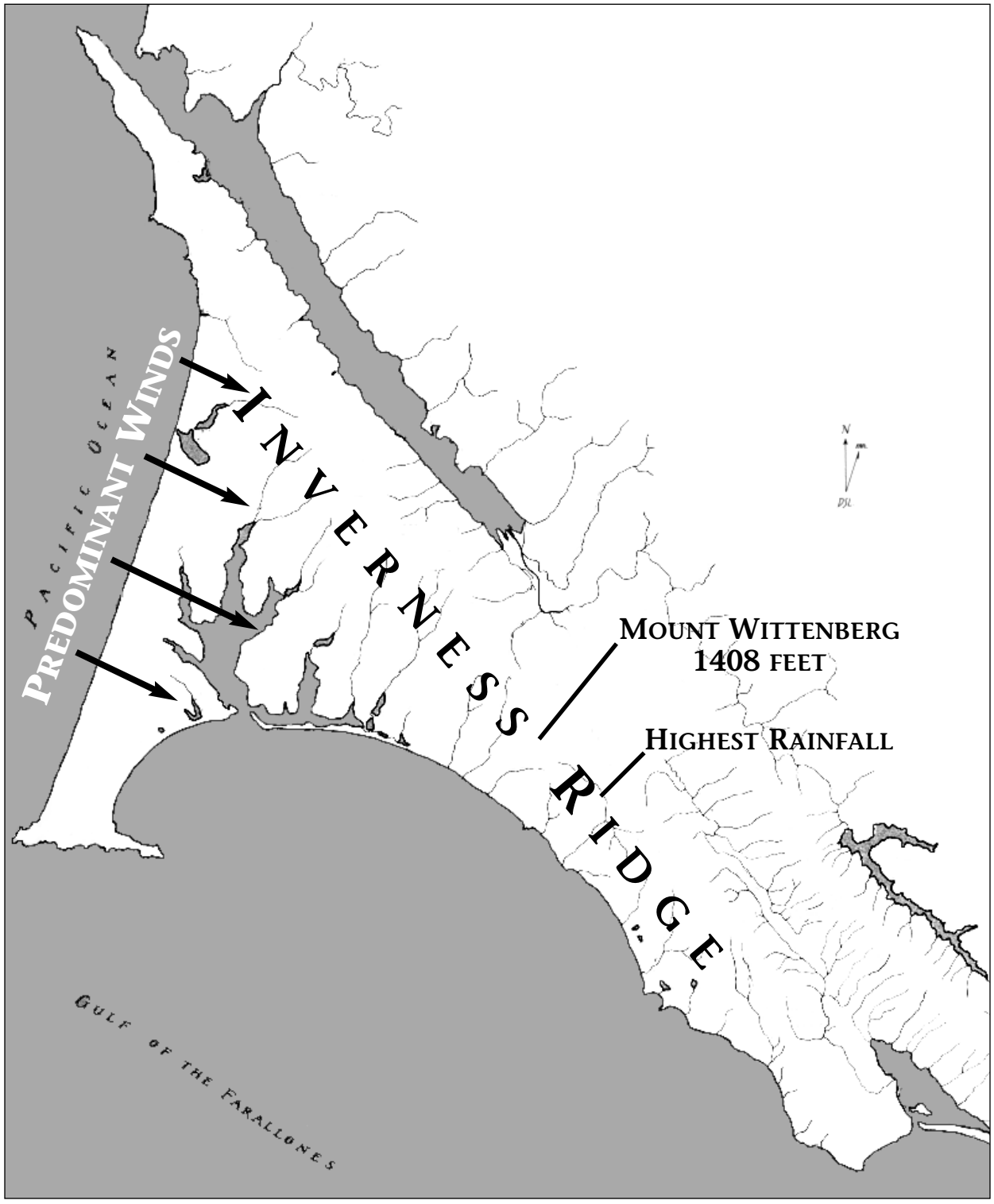
Conclusion

Using what you have read in the exhibits and what you know about rainfall, topography, and winds, create a hypothesis to explain why mixed woodland forests are found on the east side of the Inverness Ridge and coastal scrub communities are found on the west side of the ridge.

The protection from predominant winds and the increase in annual precipitation contribute to the placement of mixed woodland forest on the east side of the ridge. Because coastal scrub can survive stronger winds and needs less moisture to survive, the coastal scrub can be found on the west side of the ridge.

Teacher Master

Write On This Map!

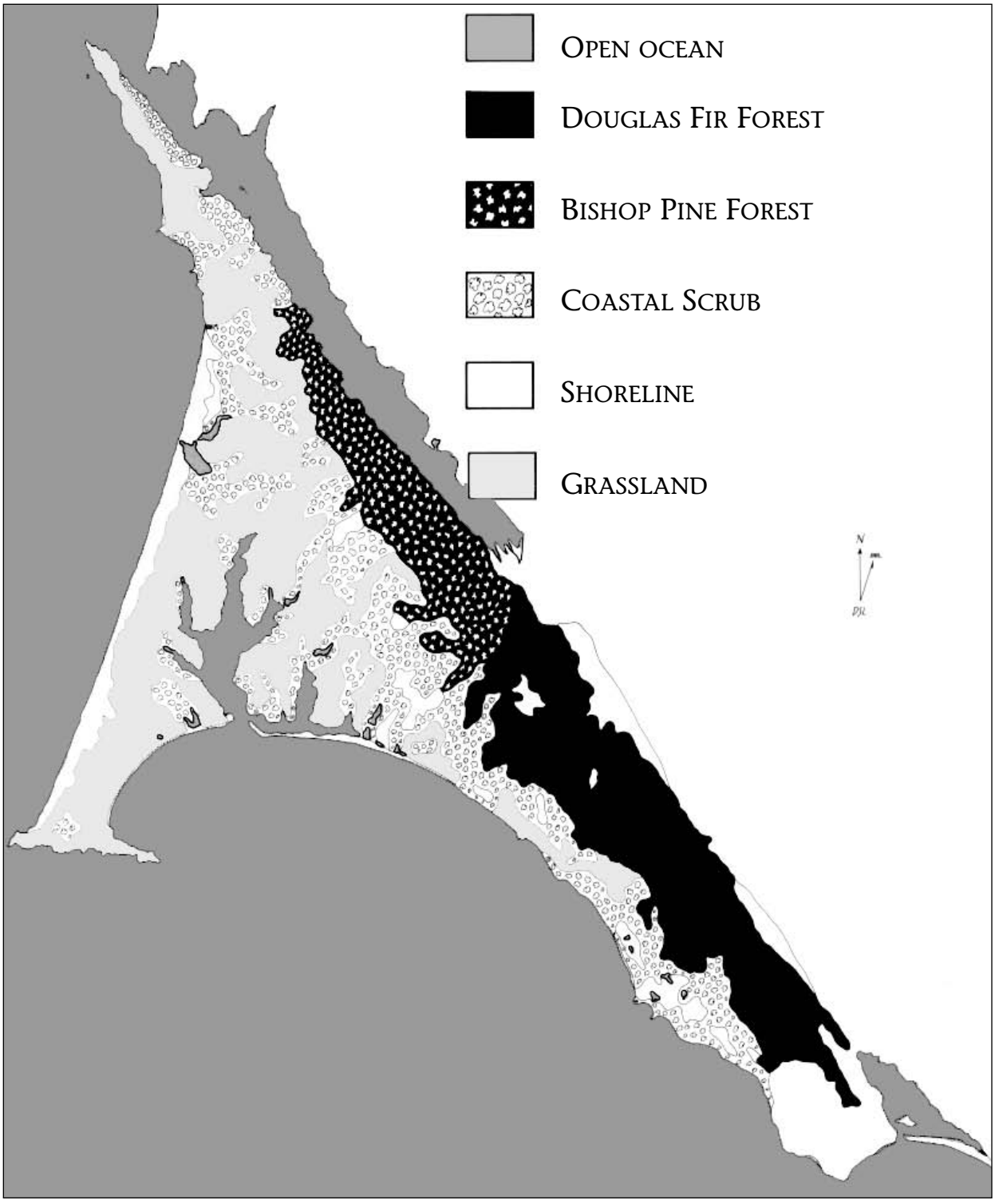


Label the following:

- two of the five habitats found at Point Reyes (see following Teacher Master)
- northwest winds
- Inverness Ridge, Mount Wittenberg (and elevation), Tomales Bay, Drakes Bay
- side of the Inverness Ridge that gets the most rainfall

Plant Communities at Point Reyes

Teacher Master



Major plant communities at Point Reyes peninsula

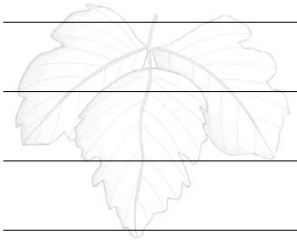
Name _____ Date _____

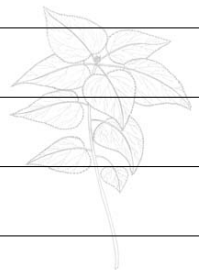
Field Journal Sheet

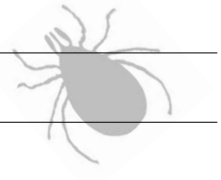
Things to Remember While on the Habitats Field Trip

Three Safety Precautions:

1. _____
2. _____
3. _____

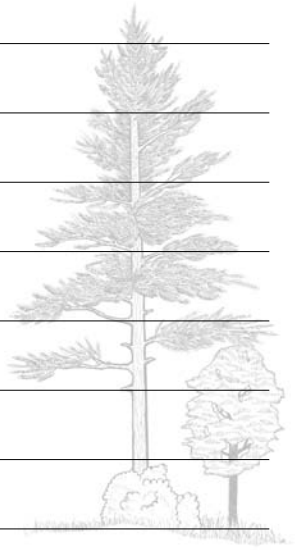






Four Resource Protection Behaviors:

1. _____
2. _____
3. _____
4. _____



Three Things to Keep in Mind When Visiting Any part of the National Park System:

1. _____
2. _____
3. _____

Name _____ Date _____

Field Journal Sheet

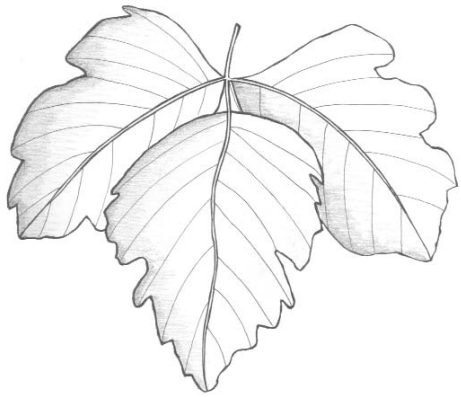
Three Things to Watch out for . . . and How to Avoid Them!!

Stinging nettle

Stinging nettle is a tall plant with needlelike hairs, which can create a burning or stinging sensation for up to 24 hours. If you see this plant, do not touch it.

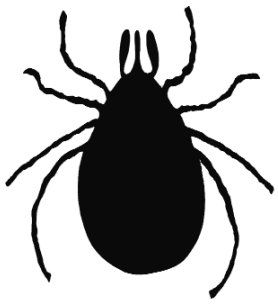
Poison oak

Poison oak has three smooth, shiny leaflets which are bright green or reddish. It can grow up trees as a vine, as a small bush, or as a small ground cover plant. Poison oak causes an itchy, blistering irritation which can last for one to two weeks. Even when leaves are not present, it is possible to get poison oak. Wash all skin and clothing that may have come in contact with poison oak with cool water and a grease-cutting soap.



Ticks

Ticks carrying Lyme disease are found at Point Reyes National Seashore. Check your body after a hike. Wear light colored long pants and shirts to help find ticks. Tuck your pant legs into your socks.



Name _____ Date _____

Field Journal Sheet

Bear Valley Visitor Center

Your job is to discover how land and ocean communities interact with environmental factors such as wind, landscape, and rain. You will answer some questions and use the blank map titled "Write On This Map!" to understand the Point Reyes ecosystem. All of the answers are in the Bear Valley Visitor Center exhibits. Remember these are exhibits; treat them with respect.

Communities, Habitats, and Species

Use the Bear Valley Visitor Center exhibits to discover which land and ocean communities are found here. Also, list two resident species for each community.

Community	Two Resident Species
1.	
2.	
3.	
4.	
5.	

Discovery Questions

One type of land community is divided into two subcommunities dominated by two different species of trees.

What community has two subcommunities?

What are the two subcommunities?

Field Journal Sheet

Name _____ Date _____

Bear Valley Visitor Center

Why are bishop pines found here at Point Reyes?

Find the Coastal Wetland Community display. Look to the left and find the panel that reads "Coastal Scrub". In which of the five community types does Coastal Scrub belong?

List five species that you would find in the Coastal Scrub community:

Map Activity

Using what you have learned in the exhibits, use "Write On This Map" Field Journal sheet to label where you would expect to find at least two of the five habitats that are found at Point Reyes National Seashore.

Environmental Factors

Use the relief map in the Bear Valley Visitor Center and the "Annual Precipitation" Field Journal sheet to discover how winds, landscape, and rain affect habitats.

Wind Factors

- Predominant winds at Point Reyes are from the west/northwest in the spring, summer, and fall.
- Wind speeds average between 25 and 40 miles per hour throughout the year. (The highest wind speed was recorded at the Lighthouse area at 133 miles per hour!)

Discovery Question

List three ways that high wind speeds can affect habitats, plants, or animals:

Name _____ Date _____

Bear Valley Visitor Center

Field Journal Sheet

Map Activity

Use arrows to label the northwest winds on the "Write On This Map" Field Journal sheet.

Landscape Factors

- The Inverness Ridge is the backbone of the Point Reyes peninsula. Its height shelters the east side of Point Reyes from strong winds.

Map Activity

Check out the relief map near the entrance to Visitor Center. Locate and label the following on your map:

Inverness Ridge
Mount Wittenberg and its elevation
Tomales Bay
Drakes Bay

Rainfall Factors

- Study the map labeled "Annual Precipitation".

Question

What is the highest annual precipitation found at Point Reyes?

Map Activity

Label which side of the Inverness Ridge gets most of the rainfall on your "Write On This Map" Field Journal sheet.

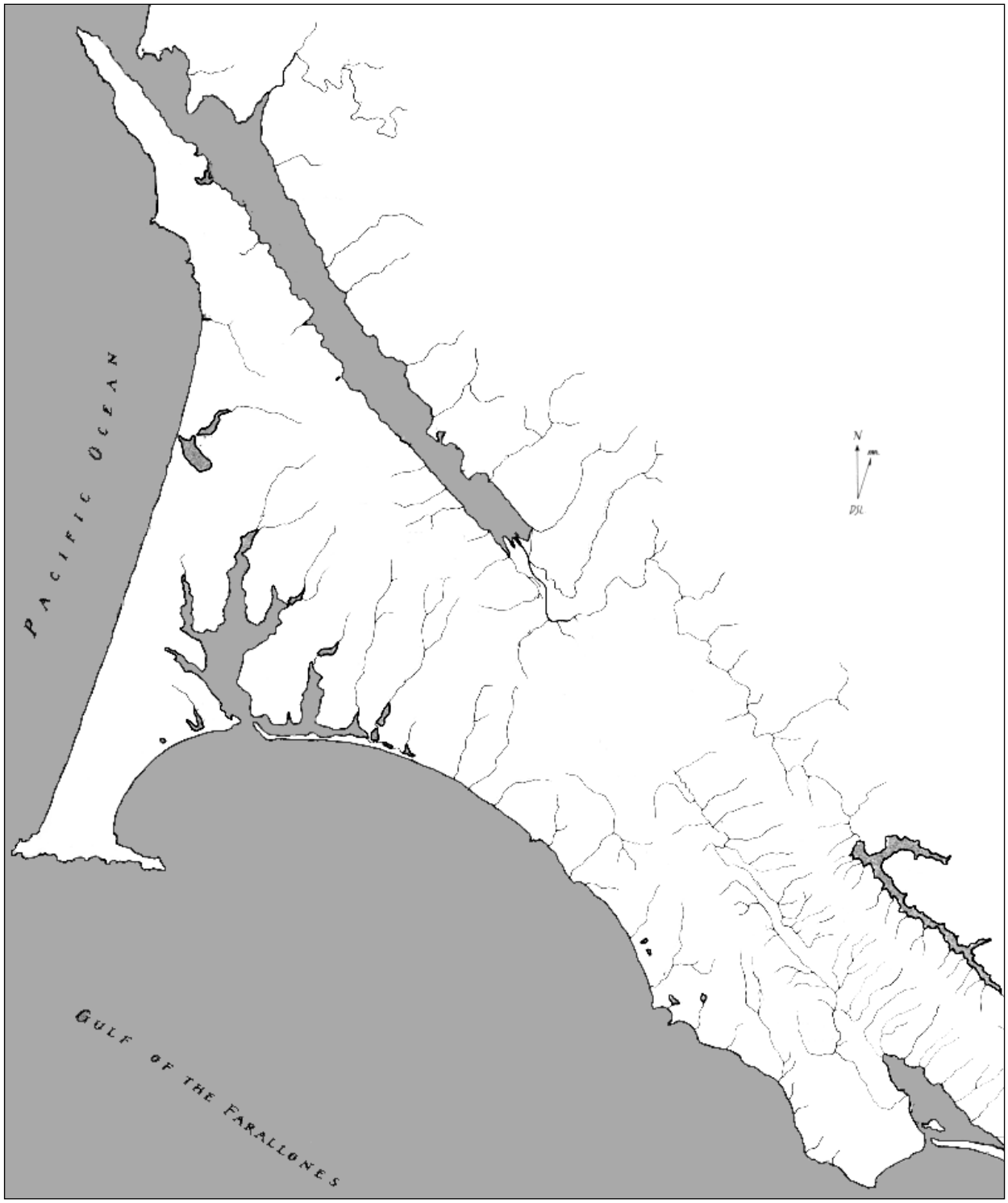
Conclusion

Using what you have read in the exhibits and what you know about rainfall, topography' and winds, create a hypothesis to explain why mixed woodland forests are found on the east side of the Inverness Ridge and coastal scrub communities are found on the west side of the ridge.

Field Journal Sheet

Name _____ Date _____

Bear Valley Visitor Center
Write on This Map!



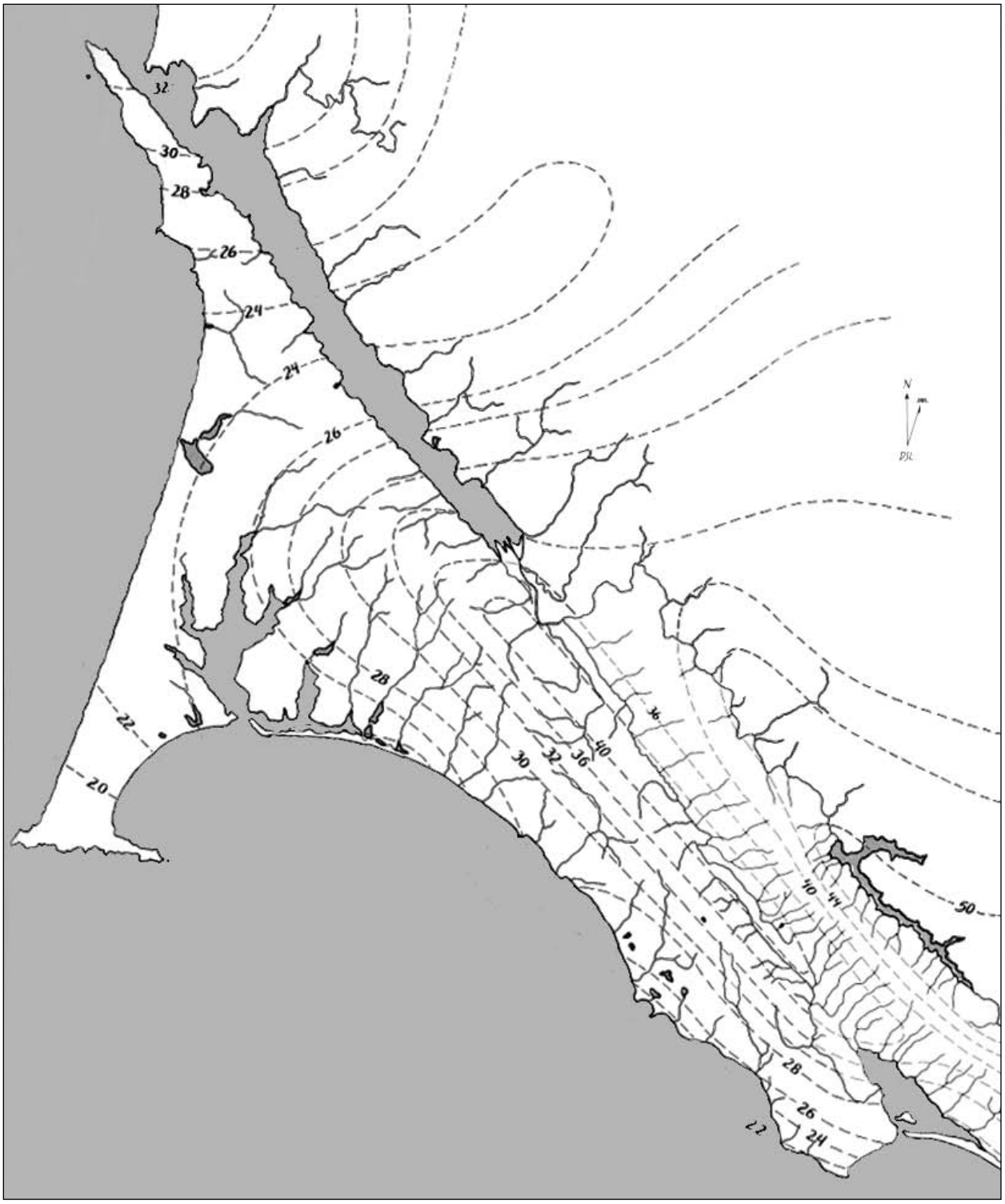
Label the following:

- two of the five habitats found at Point Reyes
- northwest winds
- Inverness Ridge, Mount Wittenberg (and elevation), Tomales Bay, Drakes Bay
- side of the Inverness Ridge that gets the most rainfall

Name _____ Date _____

Field Journal Sheet

Bear Valley Visitor Center
Annual Precipitation



Annual precipitation at Point Reyes Peninsula (based on data from Marin Water District)

Name _____ **Date** _____

Field Journal Sheet

Habitat Information

Observation start time: _____

Observation end time: _____

Location: ❑ Bear Valley Trail ❑ Coast Trail
❑ Limantour Beach/Estuary ❑ Woodpecker Trail
❑ Other

Season: ❑ fall ❑ winter ❑ spring ❑ summer

Current weather: ❑ sunny ❑ partly cloudy ❑ cloudy ❑ foggy ❑ rainy

Wind speed: ❑ calm (no wind)
❑ light breeze (leaves rustle)
❑ moderate breeze (small branches and leaves move)
❑ strong wind (trees sway)

Air temperature: _____

Terrain: ❑ Flat ❑ Along creek or drainage
❑ Gently sloping ❑ Rocky
❑ Hilly

Exposure to elements: ❑ fully exposed ❑ shaded by trees
❑ underwater ❑ exposed during low tides

Soil moisture:
Collect a handful of soil and squeeze it to determine the moisture content:
❑ Very wet—drips when squeezed
❑ Moist—no drips, but holds its form for a short time
❑ Dry—will not hold its form or is solid

Soil description: ❑ Muddy ❑ Solid ❑ Loose
❑ Sandy ❑ No soil present

When visiting Limantour Beach:

Tides: _____ Water temperature: _____

Name _____ Date _____

Field Journal Sheet

Habitat Information

Human Disturbance

Before this land was designated as a National Seashore, people used it in a variety of ways. Even today, humans directly impact the habitat at Point Reyes through hiking, horseback riding, mountain biking, and camping.

What signs of historic impact do you see?

What signs of recent impact do you see?

What are some of the unseen impacts from being so close to a major city like San Francisco?

What Habitat Are You in Right Now?

Use your observations and the "Habitat Key" on the following page to identify the habitat that you are currently visiting:

- ❑ Coastal Scrub
- ❑ Riparian
- ❑ Mixed Woodland
- ❑ Estuary
- ❑ Beach/Dunes
- ❑ Tidepools

Dominant Plants:
Based on your habitat, what two plant species should you be able to see where you are right now?

_____

_____

Common Wildlife
Based on your habitat, what two wildlife species should you be able to see where you are right now?

_____

_____

Field Journal Sheet

Name _____

Date _____

Habitat Key

	Coastal Scrub	Riparian	Mixed Woodland	Estuary	Beach/Dunes	Tidepools
Soil Moisture	DRY less than 28 inches rain/year	VERY WET (usually year-round)	MOIST to DRY receives up to 40 inches rain/year	VERY WET; influenced by tides	VERY DRY	No soil; rocky foundation
Soil Characteristics	Hard, solid	Muddy	Loose soil with decaying plants	Muddy, salty	Loose, sandy	Under water
Weather/Winds	Receives high winds and summer fog	Floods; heavily influenced by rain and runoff	Trees provide shelter from weather	Influenced by floods, coastal storms, and tides	Influenced by coastal storms and tides	Influenced by coastal storms and tides
Exposure	Fully exposed	Often shaded by fast growing trees	Heavily shaded by large trees and thick understory	Only exposed during low tides	Fully exposed; windswept	Only exposed during low tides
Terrain	Flat or hilly; along western side of Inverness Ridge and near ocean	Along creeks and drainages	Along Inverness Ridge and its eastern slope	Flat tidal zones	Gently sloping from ocean to dunes	Flat and rocky
Dominant Plants	coyote bush bush lupine cow parsnip hemlock yarrow	red alder tree stinging nettle bracken fern blackberry horsetail	live oak tree Douglas fir tree California bay elderberry poison oak	eelgrass	dune grass dune lupine beach strawberry saltbush	sea lettuce eelgrass Turkish towel kelp
Common Wildlife	black-tailed deer coyote garter snake cottontail rabbit turkey vulture California quail	raccoon Pacific tree frog coho salmon steelhead trout banana slug rough-skinned newt	black-tailed deer pocket gopher acorn woodpecker turkey vulture California quail banana slug	great blue heron northern harrier duck osprey harbor seal bat ray	willet marbled godwit harbor seal snowy plover western gull mole crab	anemone chiton sea star kelp crab barnacle mussel

Name _____ Date _____

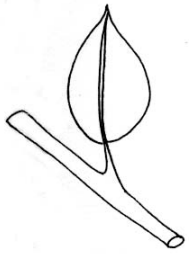
Using Leaves to Identify Plants

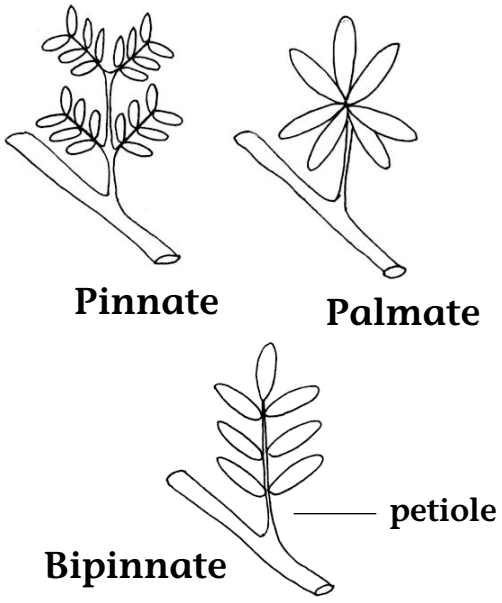
Field Journal Sheet

The way leaves look and the way they are attatched to plants will help you observe and identify plants in your habitat.

Simple Leaves

Simple leaves are easy to identify. You will be able to see only one leaf attached to the twig at each point.



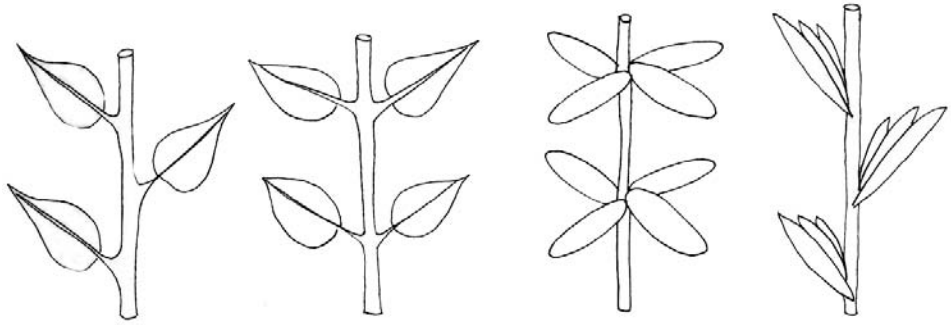


Compound Leaves

Compound leaves come in different types. They can be palmate, pinnate, or bipinnate. You will be able to identify compound leaves by the multiple leaflets that originate from the twig all attached by one larger petiole.

Leaf Attachment

Observe how the leaves are attached to the twigs.



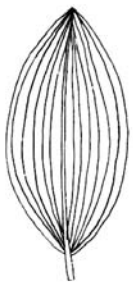
Name _____ Date _____

Field Journal Sheet

Using Leaves to Identify Plants

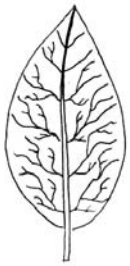
Venation

Leaf veins transport water to the leaves and food back to the roots of the plant.

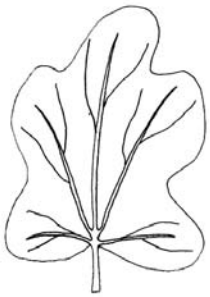


Parallel

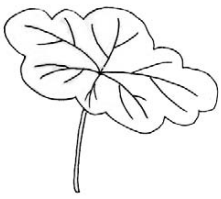
Pinnate



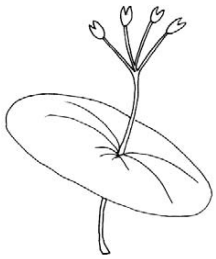
Net



Palmate



Peltate



Perfoliate

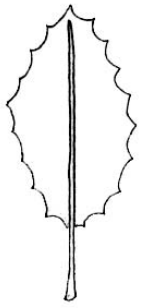
Connate

Leaf Margins

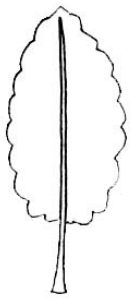
Look for different types of edges on the leaves that you are studying.

Entire

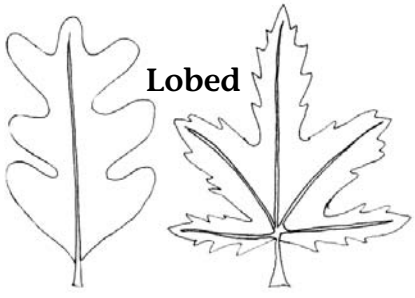
Serrate



Dentate



Crenate



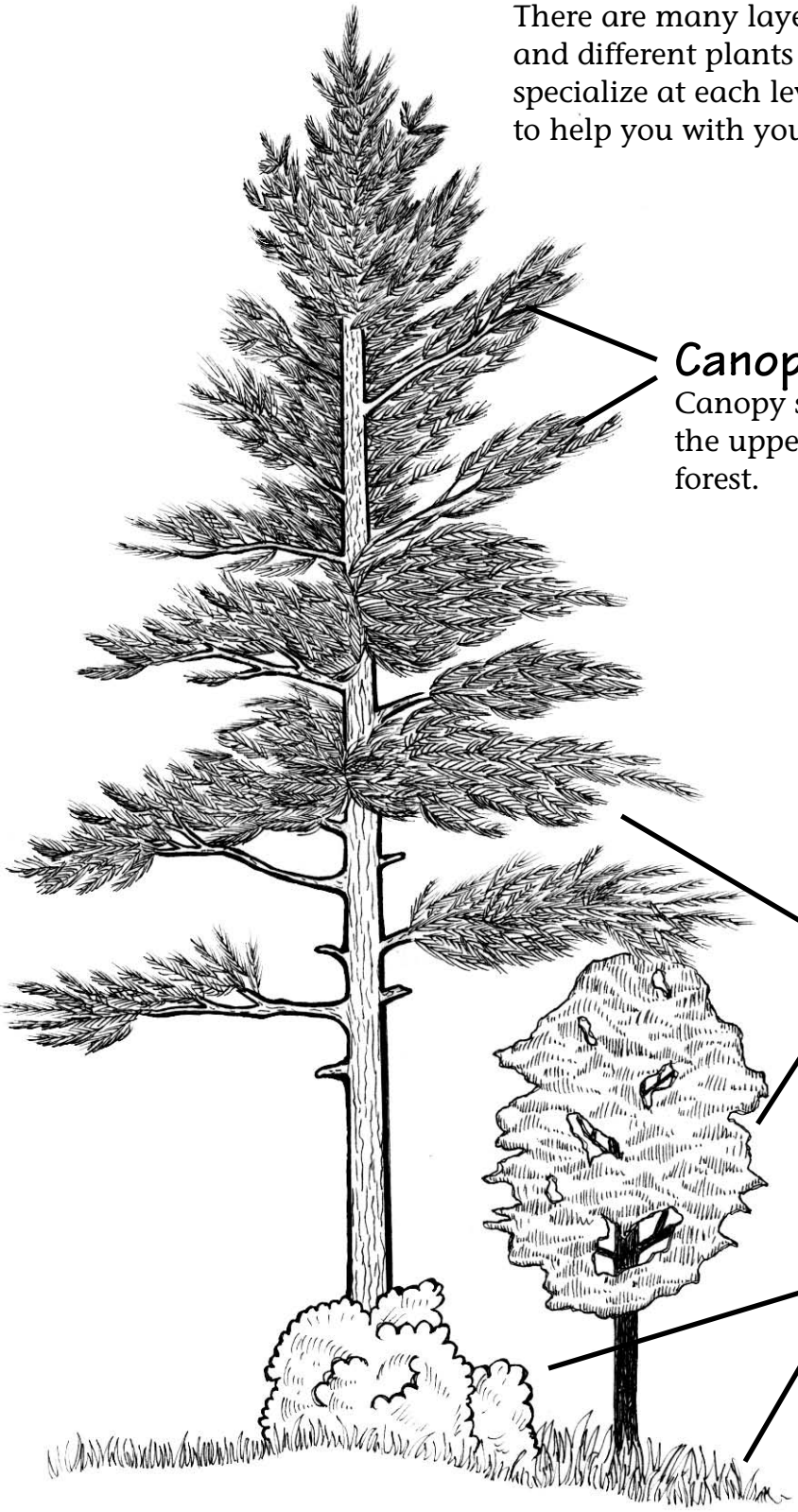
Lobed

Pinnate **Palmate**

Name _____ Date _____

Layers of Forest Life

There are many layers of life in a forest and different plants and animals that specialize at each level. Use this diagram to help you with your field observations.



Canopy

Canopy species are found in the upper level of life in a forest.

Understory

Understory species are protected by and found beneath the canopy layer.

Ground

Ground species can be found from ground level to about 10 feet off the ground.

Name _____ Date _____

Field Journal Sheet

Identifying Plants and Animals in the Field

When you don't know what kind of plant or animal you are observing, try to remember important characteris tics that will help identify the species in a field guide.

Bird:

Where is it located? What habitat are you in?
What shape is the beak?
What colors are the feathers?
What is it doing?
What is its flight pattern?

Mammal:

Where is it located? What habitat are you in?
What color(s) is the fur?
What is it doing?
How big is it?
Does it have any unique features? (antlers, big ears, short tail . . .)

Plant:

Where is it located? What habitat are you in?
What shape are the leaves?
What is the leaf arrangement?
How big is it?
Does it have any unique features? (stem shape, bark, color, flowers, cones, fruits . . .)

Amphibian:

Where is it located? What habitat are you in?
Is it a frog, toad, or salamander?
What color(s) is it?
What shape is its head and body?

Reptile:

Where is it located? What habitat are you in?
Is it a lizard, snake, skink, or turtle?
What color(s) is it?
What shape is its head and body?

Invertebrate:

Where is it located? What habitat are you in?
Is it an insect, shellfish, starfish, worm, or sponge?

Name _____ Date _____

Plant Observations

Field Journal Sheet

Habitat type: ❑ coastal scrub ❑ riparian ❑ mixed woodland ❑ estuary ❑ dunes ❑ sandy beach

Plants: Find three different plants in your area. Locate one in each category for either "seashore" or "land". Complete the chart with your observations. Watch out for poison ivy and stinging nettle!

SEASHORE	Estuary (or)	Dunes (or)	Tidepool
LAND	Ground	Understory	Canopy
Plant type: vine, shrub, tree, moss, fern, grass, herbaceous plant, other			
Height (cm)			
Stem or trunk circumference (cm)			
Stem shape or bark description			
Leaves: simple or compound?			
Leaves: How are they attached to the stem?			
Leaves: What is the vein pattern?			
Leaves: How would you describe the leaf margins?			
Describe any additional characteristics (fuzzy leaves, thorns, hairy stems, strong odor, galls...)			

Name _____ Date _____

Field Journal Sheet

Plant Observations

Sketch some or all of the plant parts listed below.

Leaf	Plant/ Flower
Bark	**Fruit, Seed, Cone**

Name _____ Date _____

Wildlife Observations

Look for different types of wildlife in your area. Fill in the chart below and on the following page with what you observe.

Circle the type of wildlife observed.	Mammals, birds, reptiles, amphibians, or other	Mammals, birds, reptiles, amphibians, or other	Mammals, birds, reptiles, amphibians, or other
Size (Approximate): height (cm) length (cm) weight (lbs)			
Color Pattern (solid, mottled, striped, spotted)			
Head *ears* (short, long, hairy, not present) *beak* (long and thin, short and blunt, not present...) *eyes* (located on front or sides) *coloration* *other features*			
Body *tail* (short, long, coloration) *body shape* (long, thin, flat, round)			
Additional characteristics			

Continued on next page...

Name _____ Date _____

Field Journal Sheet

Wildlife Observations

From your observations, fill in the rest of this chart for each species that you see.

	Circle the type of wildlife observed.	Mammals, birds, reptiles, amphibians, or other	Mammals, birds, reptiles, amphibians, or other	Mammals, birds, reptiles, amphibians, or other
Behaviors	Is this species alone or with others? (indicate numbers)			
Behaviors	What was the animal doing? (eating, resting, moving, courting, caring for young, sleeping)			
Location	What type of habitat was this animal found in? (select one: coastal scrub, riparian, mixed woodland, estuary, dunes, beach, tidepool)			
Location	Where in the habitat was this species found? (select one: ground, understory, or canopy, intertidal zone, under water)			
Identification	Draw any sign (track, scat...), if present:			
Identification	Using a field guide, identify this animal:			

Name _____ Date _____

Field Journal Sheet

Seashore Observations

Work in teams to observe the seashore habitat. Use the blank spaces to note characteristics, numbers observed, or use blank paper for sketches.

SEAWEED	
Color	
Texture	
Length	
Blade shape	
INVERTEBRATES	
ECHINODERMS sand dollar, sea urchin, brittle star, sea cucumber, sea stars	
CNIDARIANS sea anemone, hydroid, jellyfish	
CRUSTACEANS barnacle, crab, shrimp	
MOLLUSKS abalone, limpet, snail, whelk, mussel, oyster, clam, chiton, squid, octopus	
FISH	
REPTILES sea turtle	
COASTAL BIRDS	
MARINE MAMMALS whale, seal, otter	

Continued on next page…

Field Journal Sheet

Name _____ Date _____

Seashore Observations

ECOLOGICAL PROCESSES	
Hydrology Are there any streams flowing into the ocean?	
Erosion Do you see any erosion due to factors other than humans?	
HUMAN ACTIVITY	
Humans present? Activity:	
Dogs present? Activity:	
Horses? Activity:	
Trash:	
Evidence of beach fires?	
Evidence of dune erosion due to humans?	
UNUSUAL OBSERVATIONS?	

Name _____ Date _____

Field Journal Sheet

Coastal Scrub Species List

Native plants

- ❑ Cow parsnip
- ❑ Bush lupine
- ❑ Coyote bush
- ❑ Ceanothus
- ❑ California poppy
- ❑ Indian paintbrush
- ❑ Douglas iris
- ❑ Poison oak
- ❑ Huckleberry
- ❑ Bush monkey flower

Native amphibians/reptiles

- ❑ Red-sided garter snake
- ❑ Banana slug
- ❑ Pacific tree frog

Birds

- ❑ Anna's hummingbird
- ❑ California quail
- ❑ Turkey vulture
- ❑ Red-tailed hawk
- ❑ American kestrel
- ❑ Northern harrier

Mammals

- ❑ Coyote
- ❑ Spotted skunk
- ❑ Black-tailed deer (mule deer)
- ❑ Tule elk
- ❑ Mountain lion
- ❑ Pocket gopher
- ❑ Bush rabbit
- ❑ Gray fox
- ❑ Bobcat
- ❑ Deer mouse
- ❑ Raccoon

Name _____ Date _____

Field Journal Sheet

Forest Species List

Native Plants

- ❑ Coast live oak
- ❑ California coffeeberry
- ❑ Red elderberry
- ❑ California bay
- ❑ Douglas fir
- ❑ Thimbleberry
- ❑ Poison oak
- ❑ Old-man's beard
- ❑ Hazelnut
- ❑ Tan oak
- ❑ Ceanothus
- ❑ Bishop pine
- ❑ California hazelnut
- ❑ Bay laurel
- ❑ Madrone
- ❑ California buckeye
- ❑ Manzanita
- ❑ Huckleberry

Native amphibians/reptiles

- ❑ California newt
- ❑ Banana slug
- ❑ Terrestrial garter snake

Birds

- ❑ California quail
- ❑ Acorn woodpecker
- ❑ Turkey vulture
- ❑ Steller's jay

Mammals

- ❑ Wood rat
- ❑ Black-tailed deer
- ❑ Mountain lion
- ❑ Striped skunk
- ❑ Western gray squirrel

Name _____ **Date** _____

Field Journal Sheet

Riparian Species List

Native Plants

- ❑ Miner's lettuce
- ❑ Horsetail
- ❑ Stinging nettle
- ❑ Yellow willow
- ❑ Red alder
- ❑ Blackberry

Native amphibians/reptiles

- ❑ Red-legged frog
- ❑ Rough-skinned newt
- ❑ Aquatic garter snake
- ❑ Pacific tree frog
- ❑ Salamander

Mammals

- ❑ Raccoon
- ❑ Black-tailed deer

Fish

- ❑ Coho salmon
- ❑ Steelhead trout

Invertebrates

- ❑ Banana slug

Birds

- ❑ Olive-sided flycatcher
- ❑ Wilson's warbler
- ❑ Red-shouldered hawk
- ❑ Northern harrier
- ❑ Great-horned owl
- ❑ Northern spotted owl

Name _____ Date _____

Field Journal Sheet

Estuary Community Species List

Birds

- ❑ Snowy egret
- ❑ Great blue heron
- ❑ Mallard
- ❑ Green-winged teal
- ❑ Northern shoveler
- ❑ Marbled godwit
- ❑ Willet
- ❑ Osprey
- ❑ Black brant
- ❑ Pied-billed or Western Grebe
- ❑ Surf or White-winged Scoter

Native Plants

- ❑ Eelgrass
- ❑ Cordgrass
- ❑ Pickleweed
- ❑ Salt grass

Marine Invertebrates

- ❑ Washington clam
- ❑ White sand clam
- ❑ Shrimp
- ❑ Fat innkeeper
- ❑ Geoduck
- ❑ Nudibranch
- ❑ Hydroid
- ❑ Sponge
- ❑ Tunicate
- ❑ Feather-duster worm
- ❑ Red scale worm
- ❑ Pea crab
- ❑ Oregon shore crab
- ❑ Gaper clam
- ❑ Channeled basket whelk
- ❑ Tall-spired horn snail

Fish

- ❑ Goby fish
- ❑ Bat ray
- ❑ Leopard shark
- ❑ Rubberlips
- ❑ Topsmelt
- ❑ Pacific herring
- ❑ Coho salmon
- ❑ Flounder

Mammals

- ❑ Harbor seal
- ❑ Raccoon

Name _____ Date _____

Field Journal Sheet

Sandy Beach/Dune Community Species List

Birds

- ❑ Snowy plover
- ❑ Black-bellied plover
- ❑ Marbled godwit
- ❑ Willet
- ❑ Heermann's gull
- ❑ Ring-billed gull
- ❑ Western gull
- ❑ Brown pelican
- ❑ Sanderling
- ❑ Turkey vulture
- ❑ Raven

Marine Invertebrates

- ❑ "Beach hopper" amphipod
- ❑ Sand crab (mole crab)
- ❑ *Velella velella* (by the wind sailor)
- ❑ Sand dollar
- ❑ Shore crab

Plants

- ❑ American dune grass
- ❑ Sand verbena
- ❑ Saltbush
- ❑ Douglas bluegrass
- ❑ Beach strawberry
- ❑ Dune lupine
- ❑ Beach morning glory

Mammals

- ❑ Striped skunk
- ❑ Gray Fox
- ❑ Raccoon

Name _____ Date _____

Field Journal Sheet

Tide Pool Community Species List

Marine Invertebrates

- ❑ Anemone
- ❑ Nudibranch
- ❑ Chitons
- ❑ Red abalone
- ❑ Limpet
- ❑ Sea star
- ❑ Hermit crab
- ❑ Barnacle
- ❑ Goose barnacle

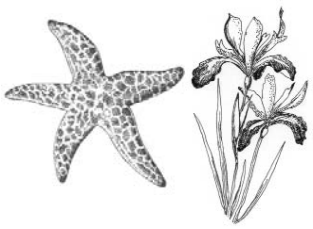
Fish

- ❑ Opaleye

Marine Plants

- ❑ Turkish towel (red algae)
- ❑ Sea lettuce (green algae)
- ❑ Eelgrass
- ❑ Surfgrass
- ❑ Sea palm

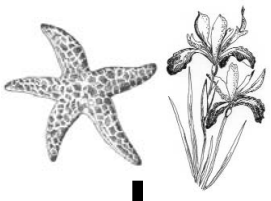
Creating
Coastal Stewardship
through Science



Defining Habitats

Post-Visit Activities

What Can We Learn from Our Field Journals?



Drawing on their field observations, students will examine food chains, food pyramids, and species distribution. Students will then identify threats to native habitats and develop strategies to monitor habitat health and compare them against current monitoring strategies in practice at Point Reyes National Seashore.

Time required: two, one-hour lessons
Location: classroom
Suggested group size: entire class
Subject(s): biology, ecology
Concept(s) covered: species identification, ecological principles, resource management
Written by: Steve Anastasia, Christie Denzel Anastasia, and Lynne Dominy, National Park Service
Last updated: 10/09/00

Student Outcomes

At the end of this activity, students will be able to:

- Determine distribution of species and habitats at Point Reyes.
- Create food webs and food pyramids.
- Identify methods for monitoring ecosystem health.

California Science Standard Links (grades 6–8)

This activity is linked to the California Science Standards in the following areas:

6th grade
- 2a- water running downhill is a dominant process on the landscape
- 2b- rivers and streams are dynamic systems
- 2c- beaches are dynamic systems in which sand is supplied by rivers
- 2d- earthquakes, landslides, and floods change human and wildlife habitats
- 4e- differences in elements such as pressure may result in changes of weather
- 5a- food webs
- 5b- organisms and the physical environment
- 5c- organisms can be categorized by functions they serve in an ecosystem
- 5d- different organisms may play similar ecological roles in similar biomes
- 5e- resources available and abiotic factors

7a- develop a hypothesis
7b- use appropriate tools/technology to perform tests, collect/display data
7c- develop qualitative statements about the relationship between variables
7d- communicate the steps and results from an investigation
7e- evidence is consistent with a proposed explanation
7f- interpret a simple scale map

7th grade
7a- use appropriate tools/technology to perform tests, collect/display data
7b- utilize a wide variety of print and electronic resources
7c- communicate logical connections
7d- construct scale models, maps and appropriately labeled diagrams
7e- communicate the steps and results from an investigation

8th grade
9a- plan and conduct a scientific investigation to test a hypothesis
9b- evaluate the accuracy and reproducibility of data

National Science Standard Links (grades 5–8)

This activity is linked to the National Science Standards in the following areas:

- Content Standard A — Design and conduct a scientific investigation; Use appropriate tools and techniques to gather, analyze, and interpret data; Develop descriptions, explanations, predictions, and models using evidence; Think critically and logically to make the relationships between evidence and explanations; Recognize and analyze alternative explanations and predictions; Communicate scientific procedures and explanations.
- Content Standard C — Structure and function in living systems; Populations and ecosystems; Diversity and adaptations of organisms.
- Content Standard F — Populations, resources, and environments; Risks and benefits.

Materials

To be provided by the teacher:

- Published field guides (see Resources page 155)
- Field journals created by each student
- Completed pre-visit plant and animal identification activity sheets

To be photocopied from this guide:

- **Forest & Layers** Activity Sheet
- **Create a Food Chain** Activity Sheet
- **Food Pyramid Activity** Sheet
- **Monitoring Ecosystem Health** Activity Sheet

Vocabulary

baseline data, distribution, dominance, ecosystem, ecosystem inventorying, food chain, food pyramid, food web, monitoring

Procedures

1. **Distribute activity**
   A. Have students work in groups.
   B. Using the "Forest Layers" Activity Sheet, have students list where they observed each plant and animal from thier field journals.
   C. Discuss and list all species on the blackboard.

2. **Food chains and food pyramids**
   A. Explain food chains.
   B. Have students create possible food chains.
   C. Use the species that were seen as well as known prey and predators that were not seen but are likely to be present in the habitat. (See Teacher Information Sheet, "Food Chain" example).
   D. From the food chain activity explain food pyramids.
   E. Create food pyramids. (See Teacher Information Sheet, "Food Pyramid" example).
   F. Explain the flow of energy that is present in food pyramids.

3. **Topic for Discussion #1**
   A. What happens when one level of a food pyramid is missing?
   B. Create hypotheses to determine the outcomes if certain levels of the pyramid are removed.
   C. Possible scenarios:
      1) Deer are over hunted.
      2) Top predators are removed because they harm livestock.
      3) Birds of prey are not reproducing successfully because of chemical contamination.
      4) Plants and habitat are lost to development.
      5) Acid rain kills large trees and other plants.
      6) Loggers harvest large tracts of forest; streams fill with silt, forests are cleared and seedlings replace tall trees.
      7) Nonnative species overwhelm the habitat.

4. **Topic for Discussion #2**
   If we did not see all of the species in our food pyramids or all of their population, how can we determine if the habitat and ecosystem are healthy or if there are any problems like the ones we talked about above?
   A. Have students complete "Monitoring Ecosystem Health" Sheet from this unit.
   B. Brainstorm, as a class, ways in which you could monitor these species.
   C. Compare your ideas with some of the Point Reyes' inventorying strategies. (Note to teacher: see the "Briefing Sheets" in this lesson.)

5. **Pre- and Post- Evaluation**
   If you saved the "Pre- and Post- Evaluation" Activity Sheets from the first pre-visit lesson, redistribute them back to the original students. Explain that students may change their answers based on what they have learned in class and on their field trip. If you choose this option, have students write in a different color pen or pencil with the date written in that color.

Post-Visit Lesson Plan

If you did not save the original Activity Sheets, make copies for each student of the "Pre- and Post- Evaluation" Activity Sheets (located in the first pre-visit activity: **How Do We Identify the Plants and Animals of Point Reyes National Seashore?**).

We would like to see the results of these evaluations! Please consider mailing completed "Pre- and Post- Evaluation" Activity Sheets back to Point Reyes National Seashore. We would like to measure the success of this curriculum and your teaching in changing knowledge, skills, and abilities.

Mail to: National Park Service
Point Reyes National Seashore
Division of Interpretation
attn: Education Specialist
Point Reyes, CA 94956

Extension Activity

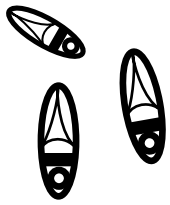
Photocopy and pass out Briefing Sheets at the end of the lesson. Allow students to read and explain some of the monitoring projects at Point Reyes to the entire class.

Create a Food Chain

Activity Master

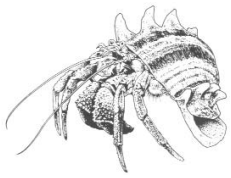
Use the animals that were observed on the field trip and their known prey and predators to create a food chain.

Sun



Phytoplankton

Zooplankton



Hermit Crab

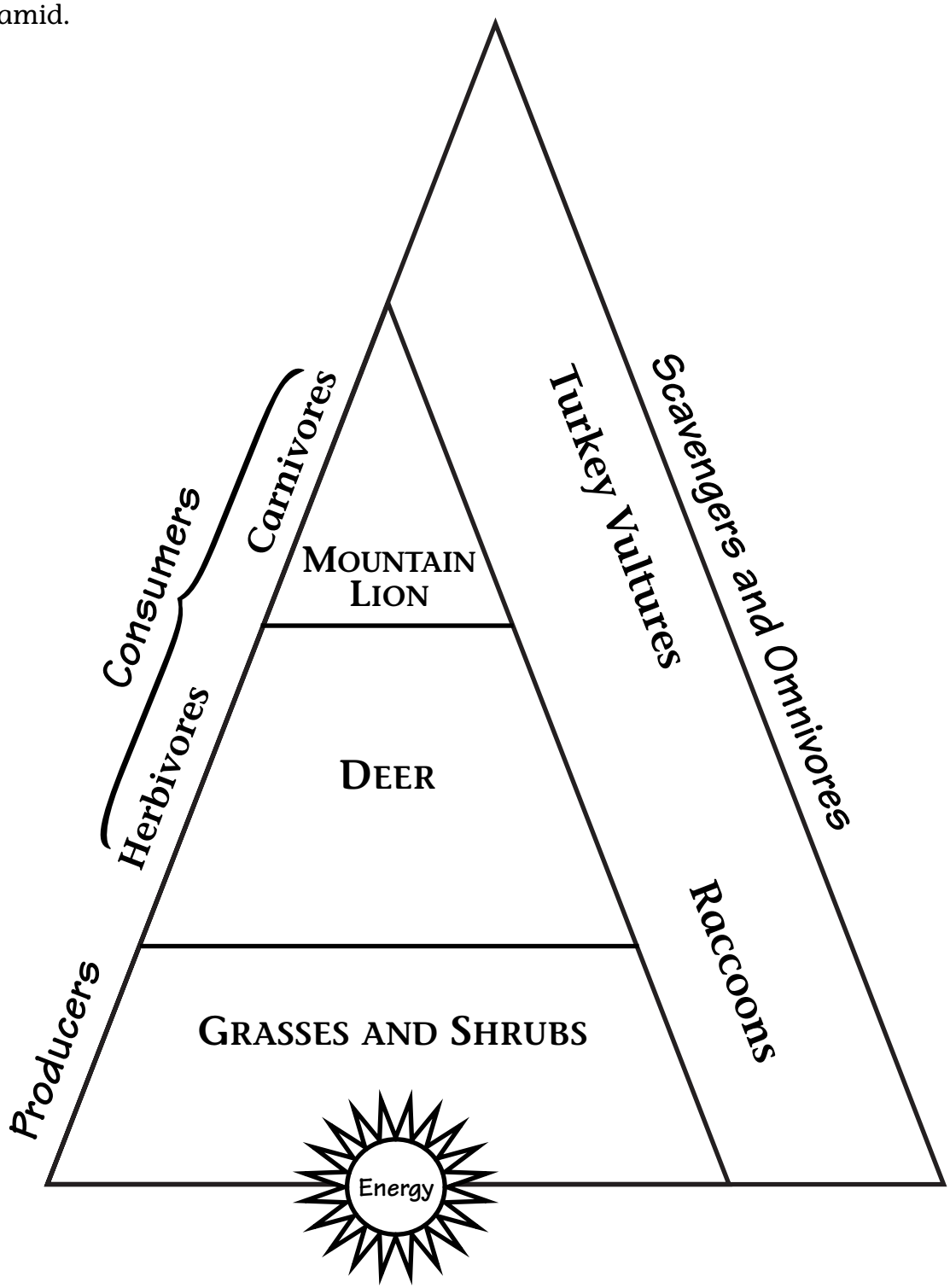
Shorebird

Raptor

Food Pyramid

Note to Teachers: ***Food chains are sometimes misleading. Food chains determine links between species but do not address the number of a specific animal population that a specific habitat can support. Food pyramids can help to clarify this.***

For example: It takes many more individual grasses and shrubs to support the deer that feed on them. The same is true for the deer the mountain lions that feed. The number of mountain lions that are sustained by the herd of deer will be significantly smaller than number of the deer they feed on. This narrowing of species is a food pyramid.



Monitoring Ecosystem Health

Activity Master

Read NP 10 of the newspaper. Determine which category of species you would monitor and why. Give an example of each.

1. Federally threatened and endangered species because they are close to extinction. ***Example: Northern spotted owl***

2. Sensitive species are monitored because they are often good indicators of total ecosystem health and disturbance. **Example: Common murres**

3. Keystone species often are integral to the health of the entire ecosystem because many other species depend on them for their survival. **Example: Bishop pine trees**

4. Heroic species are studied and monitored because their wildness and symbolism are important to us as a society and demand their protection. ***Examples: Tule elk and elephant seals***

In the article, find one example of how ecosystems are being monitored at Point Reyes National Seashore. List it below.

- ***Habitats and ecosystems are monitored by using volunteers and staff to collect field data through observation.***
- ***Remote trail cameras and live-trapping arrays are also used as a tool to sample animal diversity.***

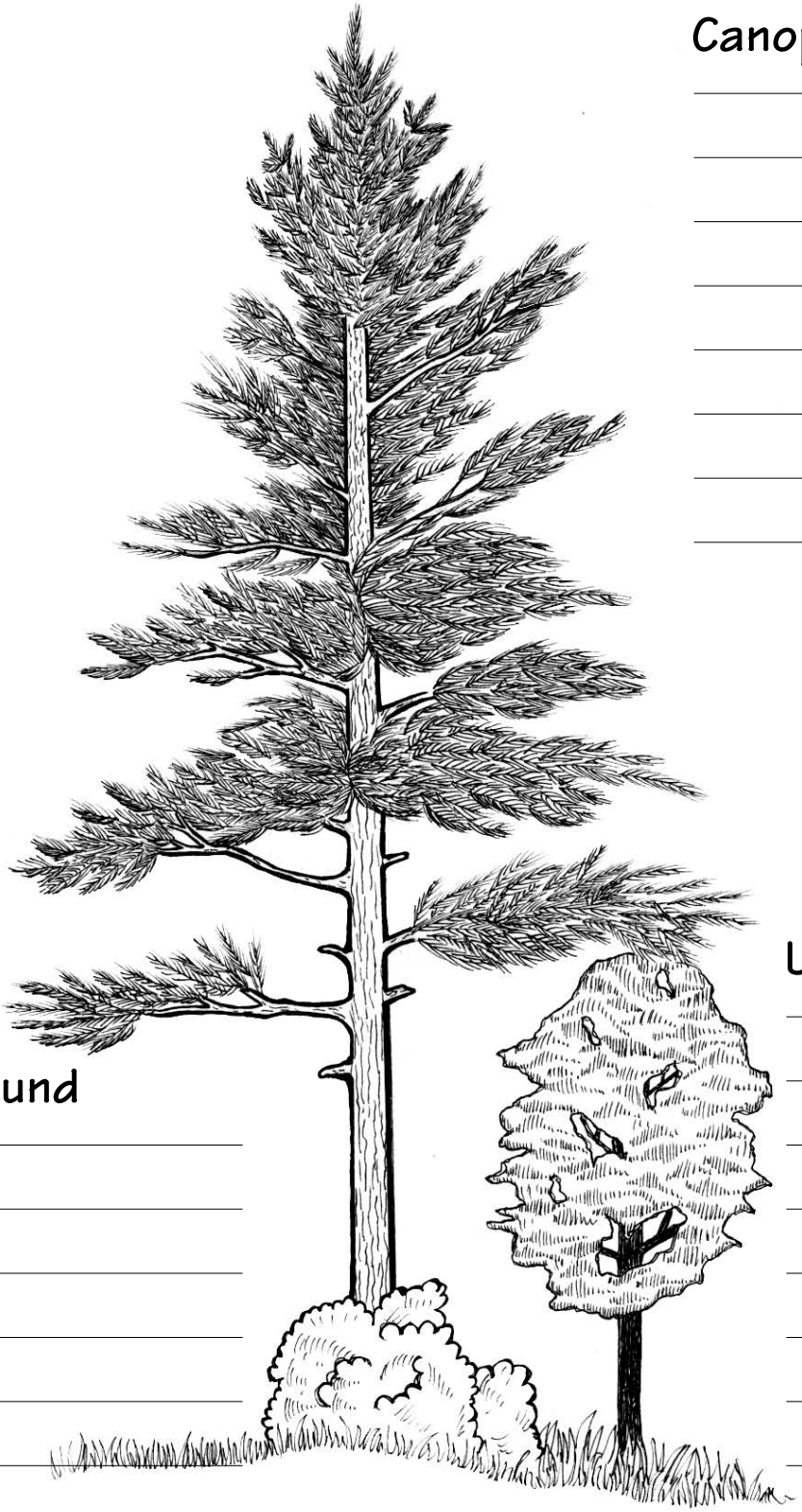
Brainstorm some ways that you would monitor the ecosystems and habitats of Point Reyes. Make sure to include what species of plants and animals you would study and why.

- ***Answers will vary; compare to actual monitoring systems listed in Teacher Information Sheets.***

Forest Layers

Activity Sheet

List the forest layer where most observed species were found.



Canopy

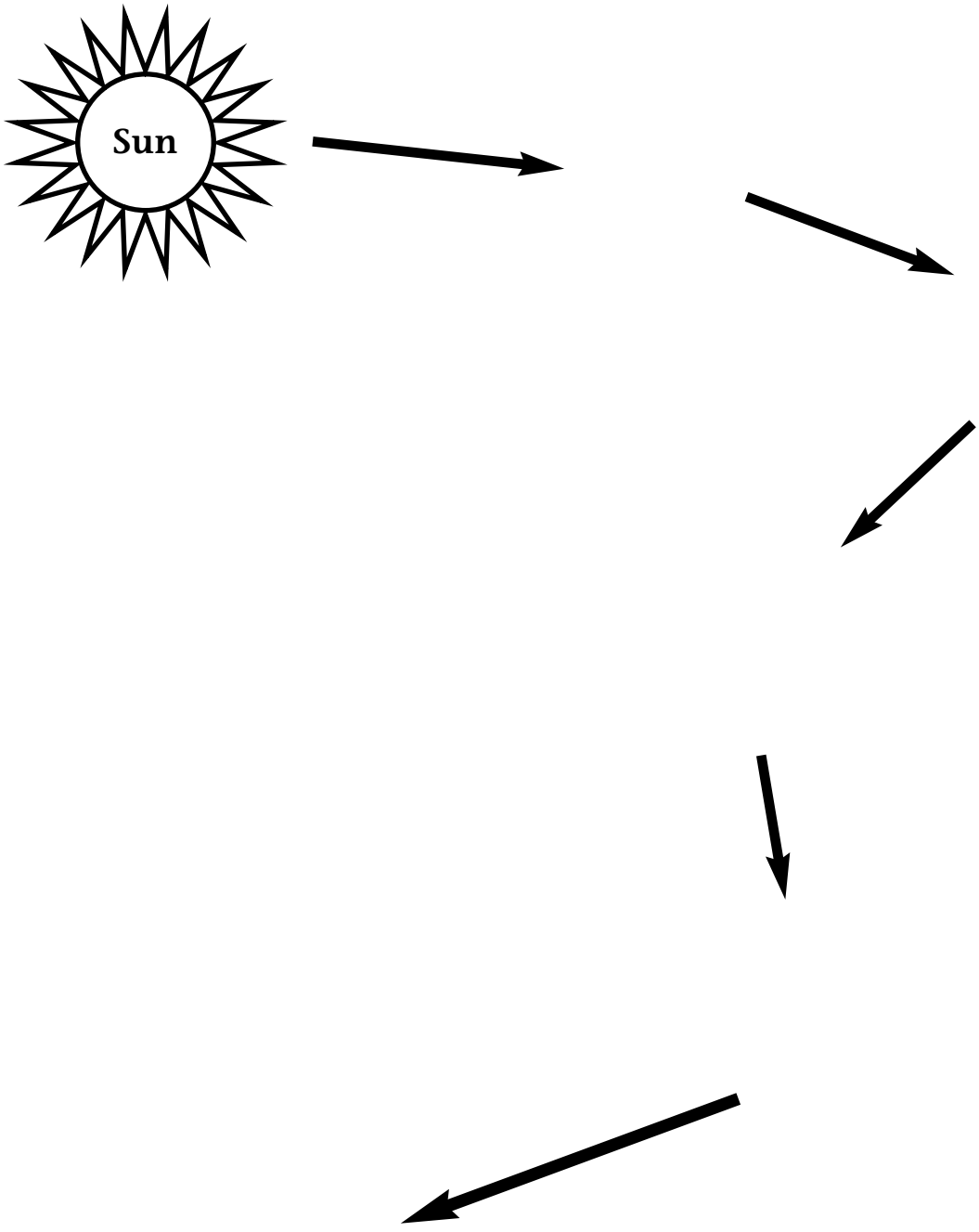
Understory

Ground

Activity Sheet

Create a Food Chain

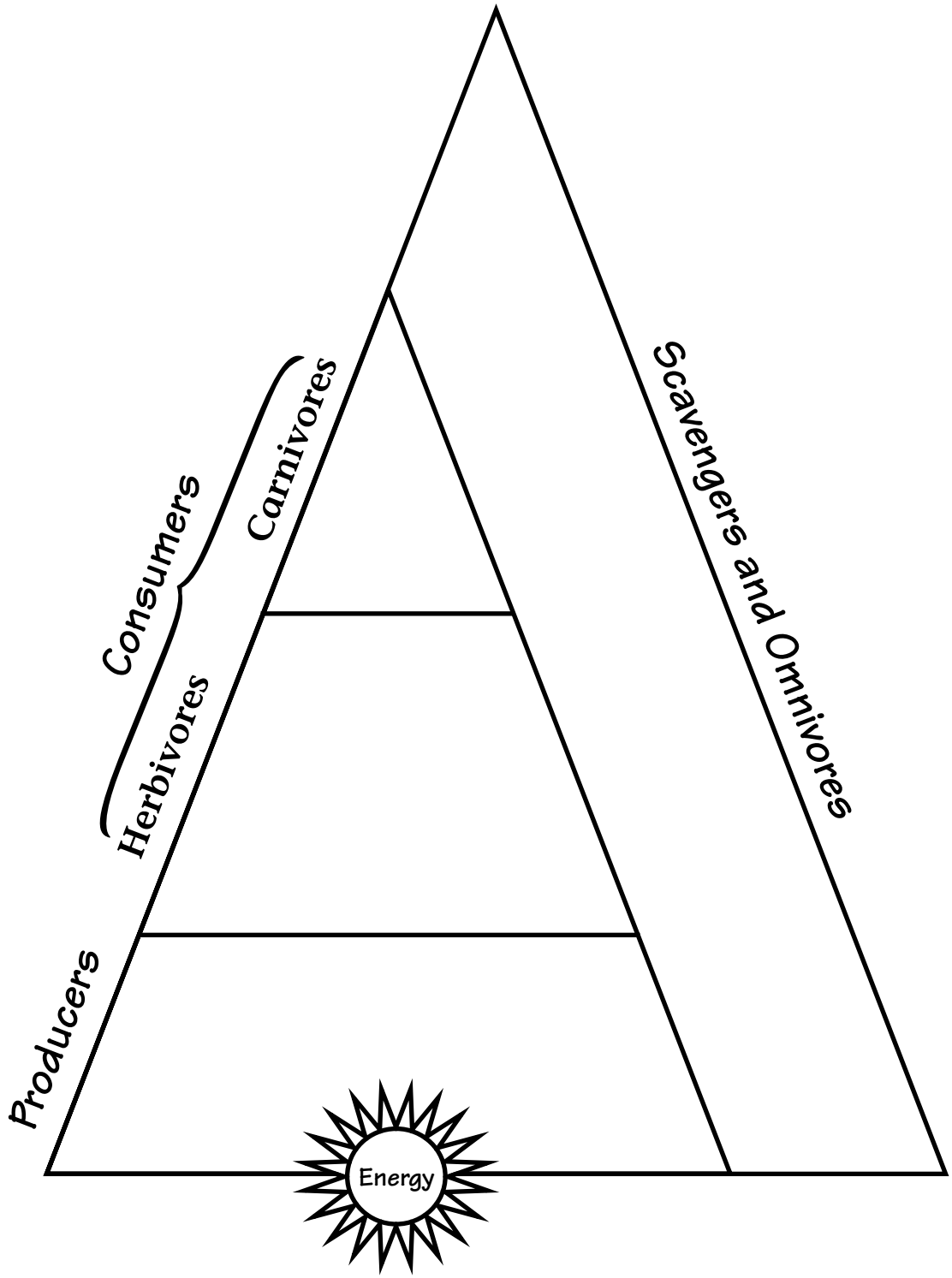
Use the animals that were observed on the field trip and their known prey and predators to create a food chain.



Food Pyramid

Activity Sheet

Build a food pyramid from your food chain on the previous page.



Activity Sheet

Monitoring Ecosystem Health

Read NP 10 of the newspaper. Determine which category of species you would monitor and why. Give an example of each.

1.

2.

3.

4.

In the article, find one example of how ecosystems are being monitored at Point Reyes National Seashore. List it below.

Brainstorm some ways that you would monitor the ecosystems and habitats of Point Reyes. Make sure to include what species of plants and animals you would study and why.

Briefing:
Mammal Inventorying and Monitoring, Phase One
Live Trapping and Remote Photography

What is the objective of the project?
The project, which is being conducted by the US Geologic Survey, Biological Resources division, has been implemented to determine what animal species are present at Point Reyes National Seashore, where, and in what concentration. This information provides data that can help in assessing the overall health of the ecosystem. The data also establish a baseline that can be used to detect any changes in mammal populations that may affect each of the studied habitats.

How long is the study going to last?
The first phase of the study is scheduled to last 3 years. Fall 2000 is the final year of the project.

Where does the study take place?
The study is conducted at eight habitat locations:

Bishop pine:	2 locations
Douglas fir:	2 locations
Riparian:	1 location
Grassland:	1 location
Coastal Scrub:	2 locations

How is the study performed?
Each location has one remote sensing camera triggered by an infrared beam. When the infrared beam is tripped by an animal, the camera takes a photo of the species in the area of the beam. Each location also has four live-trap arrays located 50–100 yards apart for small mammals, amphibians, and reptiles. (See array photo.) Each site is checked daily for one week each month. When sites are not being checked, all traps are closed.

In total, there are 32 live-trap arrays and 8 remote sensing cameras throughout the park.

What is being learned by the study?
Both the arrays and the cameras provide important information not previously known about the ecosystem and habitats of Point Reyes National Seashore. The information provides a baseline for all future monitoring.

Currently the ecosystem is deemed healthy by biologists.

Teacher Information

Phase Two: Monitoring (Implemented after inventorying is complete, Fall 2000)

What is the objective of the project?
The second phase of the project is designed to monitor ecosystem health, to identify any changes in species population ,and to identify management strategies that can keep the ecosystem healthy. The data collected in the monitoring phase will be compared to inventorying data. This comparison will be used to monitor the future health of the ecosystem.

How long is the study?
The study will start in the fall of 2000 and continue on a small scale indefinitely.

Where will the study take place?
The study is conducted at 16 habitat locations:

Bishop pine:	2 locations
Douglas fir:	3 locations
Riparian:	2 locations
Grassland:	4 locations
Coastal scrub:	4 locations
Redwood:	1 location

What are the methods?
The methods are the same as Phase One of study (inventorying) but less intensive. Through the inventorying process, two important times of year have been identified for monitoring. These two time periods give an accurate sampling for the entire year. Monitoring arrays and collection of data will be performed only at these times.

Briefing:
Endangered Red-legged Frog Monitoring

What is the objective of the project?
To date, very little is known about the endangered red-legged frog. The project, which is being conducted by the US Geologic Survey, Biological Resources division, is designed to better understand red-legged frog behavior to develop sound management practices.

When does the project take place?
Research is done throughout the year with the concentration of work in the fall, winter, and spring.

How is the study performed?
In the breeding season (winter), the location and number of egg masses are recorded. Throughout the year, individual frogs (currently 15) are radio tagged and tracked to determine nonbreeding behavior. Frogs are also pit tagged with small electronic tags that are placed under the skin. These tags work like a barcode allowing researchers to identify and record specific data about an individual frog.

What is being learned from the study?
Researchers are learning accurate information about the red-legged frogs. Currently there are fewer than 50 known breeding sites at Point Reyes. Additionally they are learning about frog behavior in the nonbreeding season. This information is being used to develop effective management strategies.

Teacher Information

Briefing: Coho Salmon and Steelhead Trout Restoration and Monitoring Project

What is the objective of the project?
The principal aim of the project is to restore endangered coho salmon and steelhead trout to the streams of the National Seashore and other federal lands. This is done by improving streams and waterways for coho salmon and steelhead trout habitat and breeding.

When is the project active?
The project is active all year with different aspects of the project occurring when environmental conditions and fish biology are appropriate.

Which streams and watersheds are involved in the project?
Olema, Lagunitas, Redwood and Pine Gulch Creeks and their tributaries are all being monitored and improved where necessary.

What actions are being taken to improve coho and steelhead habitat?

1. Obstacles to fish migration upstream are being removed by creating natural fish passage structures.
2. Riparian corridors are being restored by planting native riparian plants like willows and removing cattle from the streambeds.
3. Creeks are monitored using 100-meter index sections that typify major stream habitat types in the watersheds.
   a. Each index section is "fished" using an electrofishing device. Fish are momentarily stunned and collected. They are weighed, measured , and counted.
   b. Steam populations are extrapolated based on data collected in the index sections.
4. Spawning fish are surveyed by volunteers and researchers.
   The number of spawning fish is recorded during the rainy season when steelhead and coho are traveling up the stream corridors to determine ideal habitat and extrapolate fry populations.
5. Estimating smolt numbers.
   Fish moving out to sea are trapped, counted, and released to extrapolate the number of fish surviving from fry to smolts.

All data are used to determine long-term trends in populations and to gauge the success of restoration projects.

Briefing: Northern Spotted Owl Inventorying and Monitoring Project

What is the objective of the project?
The purpose of the project is to document and determine nesting productivity of the threatened northern spotted owl. Trends can be quantified to determine the long term productivity and density of northern spotted owls. Based on the collected data, appropriate management actions can be taken to protect the Point Reyes species population if necessary.

When does the monitoring occur?
Monitoring occurs February through September.

Where does the monitoring occur?
The Seashore is working with federal and state management in Marin County to monitor all suitable habitat in the county. Within the Seashore monitoring occurs in the forests of the Inverness and Bolinas Ridges.

What are the methods?

1. Field researchers locate owls by calling them via taped owl call or voice call that imitates the northern spotted owl.
2. If there is a response from the owl, researchers find its location.
3. Researchers determine if the owl is a solitary owl or part of a pair. If it is a pair the owls are observed to find their nest, if present.
4. Researchers return to the nesting site once a week to determine fledging success.
5. Data are analyzed and compared to previous years to determine positive or negative trends.

Teacher Information

Briefing: Elephant Seal Monitoring

What is the objective of elephant seal monitoring?
By monitoring elephant seals at Point Reyes, researchers and scientists determine trends in the age and sex structure of the seal populations, migration, and reproductive success. These data are used to determine trends and quantify annual reproductive success.

When does the monitoring happen?
Elephant seals arrive at Point Reyes in December to give birth to pups and breedand stay through March. From May through July, seals return to Point Reyes to molt (shed and regrow their entire fur coat).

Where does the monitoring happen?
The monitoring occurs in all the elephant seal colonies that are found on the Point Reyes Headlands, including the Drakes Beach colony that is visible from the Elephant Seal Overlook near the Chimney Rock parking lot.

What are the methods?
Researchers visit elephant seal colonies regularly during the pupping and mating season. They count the number of elephant seals according to age and sex, births and deaths, and document unusual behavior.

1. Some seals are tagged to provide information on migration and site fidelity for breeding.
2. Other seals are fitted with radio tags to track and transmit information on seal behavior while at sea. These temporary radio tags fall off when the animal molts.

Briefing: Intertidal Monitoring

What is the objective of intertidal monitoring?
The objective is to create a system for long-term tracking of the Point Reyes intertidal environment integrity. This will establish a baseline condition for monitoring and documenting changes to this area, whether they are natural (plant succession, strong storm damage) or human-caused (oil spills).

When does intertidal monitoring happen?
Resource Management surveys the site twice a year, usually around November and May, during a low tide series.

What locations are surveyed?

1. Bolinas Point
2. Elephant Rock/McClure' Beach,
3. Santa Maria Creek/Coast Camp (near Sculptured Beach).

How were these locations chosen?
These locations are distributed as evenly as possible along the study area coastline, while also avoiding areas utilized by sensitive bird and mammal species.

What sites are surveyed at these locations?
There are two subareas in this habitat that are surveyed: areas characterized by algae and areas characterized by California mussels.
There are two types of surveys at each subarea: fixed and random. The same methods (see below) apply to both types.

Fixed: these sites are the same each year and allow annual changes of the exact location to be documented. They are marked by cattle tags and can be located by using a permanent mark, compass, or GPS (global positioning). Sometimes wave action will remove the cattle tags.

Random: Twenty-four numbered weights are thrown out randomly and all weights are picked up except weights numbered 1-6. They are left where they landed. These will be surveyed with the methods listed below.

The end result at the Rocky Intertidal Habitat is six random and six permanently marked samples in both the mussel-dominated and algae-dominated assemblages. (Repeated at Bolinas Point, Elephant Rock, and Santa Maria Creek).

Teacher Information

Briefing: Intertidal Monitoring (continued)

How is the Rocky Intertidal Habitat monitored?

1. **To monitor sessile (stationary) species and substrate (rock) percentages:** A tablelike setup with adjustable legs is placed over the site to be surveyed. The tabletop is a rectangle shaped Plexiglas with 160 bored holes and 25 pre-designated random points labeled. A long pin is dropped through each random hole and a record is made of what the pin hits. Each hit will represent 2.2% of that species distribution. Hits included: seaweed/algae, barnacle, mussel, substrate.

2. **To monitor other species present:** A plastic rectanglular frame is laid down directly under where the Plexiglas table stood. Any other species in the perimeter which are present, but not recorded by a pin hit, are documented.

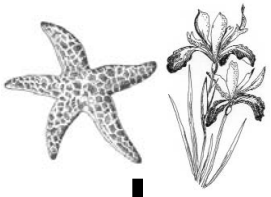
3. **To monitor motile (moving) species:** A square frame is laid down in the center of the plastic rectangular frame. All motile species are counted and recorded. Species include: predatory whelk (*Nucella* spp.), periwinkle (*Littorina* spp.), black turban snail (*Tegula* spp.), isopod, chiton, and worms.

4. **To monitor sea stars:** Someone walks the entire designated area and counts each type of sea star present. Species include: purple sea star (*Pisaster ochraceous)*, bat star *(Patriria giganteus)* and common sea star (*Pisaster giganteus*).

5. **Photo documentation:** a bird's-eye photo was taken of every survey site and 72 other random photos were taken.

6. **Disturbance survey:** any noted disturbances such as sand inundation, rock exfoliation, oil, or evidence of otter feeding are also photographed. Salinity and water temperature are also noted.

How Do I Choose and Complete the Best Stewardship Project?



Post-Visit Lesson Plan

The final lesson for this unit synthesizes all previous learning experiences. Students have had the opportunity to gain an understanding of habitat types and some of the threats to their sustainability. Now it's time to take action to keep habitats distinct, native, and healthy for the variety of organisms that depend on them, including humans.

Time required: time varies
Location: classroom, community, or Point Reyes National Seashore
Suggested group size: entire class

Subject(s): biology, art, computer skills, community service
Concept(s) covered: stewardship, educating others, environmental responsibility

Written by: Lynne Dominy and Christie Denzel Anastasia, National Park Service
Last updated: 10/07/00

Student Outcomes

At the end of this activity, students will be able to:

- Synthesize all other pre-visit, on-site, and post-visit lessons from this unit.
- Plan and implement an environmental stewardship activity to benefit the ecosystem they live in and depend upon.

National Science Standard Links

As a result of this activity, all students in grades 6–8 should develop:

- Content Standard F—Science in Personal and Social Perspectives; Populations, Resources, and Environments.

Materials

To be provided by the teacher:

- Varies by project, see Teacher Information "Defining Habitats: Environmental Stewardship Projects"

Vocabulary

stewardship

Procedures

1. **Decide on lesson approach based on time limitations**
   Review the Teacher Information "Defining Habitats: Environmental Stewardship Projects" following this lesson. This teacher resource explores the range of stewardship projects your class can complete according to time constraints. There are many possibilities ranging from short lessons to more in-depth, interdisciplinary projects that may fulfill educational standards for other subject areas.

2. **Prior to starting a stewardship project, introduce the concept of environmental stewardship**
   Begin a discussion of who has responsibilities for natural resources. There are federal agencies such as the National Park Service, United States Forest Service, state agencies such as California Fish and Game, and local organizations. Introduce the concept that organizations such as schools and individuals such as students also have responsibility.

   Based on our daily behaviors, we choose what our impacts are to the environment. They are usually positive or negative, rarely neutral.

3. **Lesson options**
   - How to Positively Affect Species and Their Habitats
   - Create Tools to Educate Others
   - Implement a Community Project
   - Participate in Volunteer Programs at Point Reyes National Seashore
   - Support Stewardship Organizations and Be an Advocate for Your Beliefs

   (see the Teacher Information "Defining Habitats: Environmental Stewardship Projects" following this lesson for more details)

4. **Assist with evaluation of *Creating Coastal Stewardship through Science***
   Please share your project ideas and results! If you develop a website, host a *Coastal Stewardship Day*, or participate in a beach cleanup, let us know by sending photos, stories, or student materials. Call (415) 464-5139, to leave a message with the Education Division of Point Reyes National Seashore.

Defining Habitats
Environmental Stewardship Projects

How to Positively Affect Habitats.

One to two lessons

Students use the "How to Positively Affect Land Habitats" or the "How to Positively Affect Seashore Habitats" Activity sheet (at the end of this lesson) to learn more about how species become extirpated from land habitats and how nonnative plants can destroy native dunes. Based on that investigation, students devise action plans for which they assume responsibility for contributing toward healthy habitats.

Create Tools to Educate Others.

Arranged in order of possible time commitment, shortest to longest

Lead a class discussion to brainstorm ways students can educate others. Use the list below to help students generate ideas. Once there are a number of ideas, decide which project can be completed within a designated timeframe. The next step is to have students create a "plan of action". What are all the things that need to be done, in which order do they need to be done, who is going to do them, and what are the deadlines? How can students not only teach about the resource, but also impart stewardship values? Remind students to think about any safety issues and address these as a group.

Educational tool ideas:

- Develop a newsletter or newspaper to distribute to other students.
- Build an exhibit that is displayed for a parents' open house.
- Paint a mural, draw posters, or create a website that encourages habitat Stewardship.
- Interview a researcher about a habitat restoration project. Share the answers.
- Organize a Coastal Stewardship Contest. Have students define stewardship through writing essays or creating art, poetry or music.
- Videotape your field trip and stewardship activities. Have the students narrate this video and develop a presentation for other students sharing what they have learned and accomplished.
- Create a mentoring program that enables your students to teach younger students about resources and their stewardship.

Teacher Information

Defining Habitats
Environmental Stewardship Projects (continued)

Implement a Community/School Project.

Arranged in order of possible time commitment, shortest to longest

Instruct students as a homework assignment to find at least one local environmental issue that is being discussed among community members. Students may gain this information by looking through newspapers, talking to their parents, watching the local news, or listening to a public radio station. The next day in class, all local environmental issues should be discussed to some extent. Choose one project around which students may design a stewardship project. What are the possible stewardship activities that can be completed by students, and/or their parents, and communities? Follow the ideas in the procedure above to create a "plan of action".

Community/School Project Ideas:

- Practice water conservation at school and home.
- Create a green school: investigate recycling and composting facilities or water conservation. Create a native plant garden. Have students write a plan about how to make your school more environmentally friendly. Have them take action and implement some of their ideas.

Participate in Volunteer Programs at Point Reyes National Seashore.

Two hours, full day, or regular commitment on weekly/monthly basis

Students may participate in programs at Point Reyes National Seashore such as restoration, rehabilitation, or research projects. Consult with the Volunteer Coordinator or Education Specialist for the most recent options, as projects can change according to time of year and staffing availability. One example of participating in a restoration project is to remove nonnative plants from natural areas. To participate in the habitat restoration projects at Point Reyes National Seashore call (415) 464-5139. Habitat restoration may also be done in conjunction with your Park field trip, when it is arranged two or more weeks in advance. A beach cleanup may also be scheduled in conjunction with habitat field trips, when it is requested in writing in advance. Visit the Seashore's website at ***www.nps/gov/pore*** for more information on scheduling these opportunities.

Defining Habitats
Environmental Stewardship Projects (continued)

Support Stewardship Organizations and Be an Advocate for Your Beliefs.

One lesson to lifelong commitment

Introduce students to the concept of advocacy. Have them research and represent the missions of local and national stewardship organizations. Examples include: the National Park Service, the Marine Mammal Center, the Humane Society, the Sierra Club, the National Parks and Conservation Association, and the Audubon Society. Have students write letters to their local, state, and national government officials regarding issues, or have them submit articles to local newspapers. Encourage students to form educated opinions and to voice them.

Name _____ **Date** _____

Activity Sheet

How to Positively Affect Land Habitats

Choose and research one of the following species to answer the questions below:

❑ Gray wolf	*Canis lupus*
❑ Grizzly bear	*Ursus arctos*
❑ Black bear	*Ursus americanus*
❑ Marten	*Martes americana*
❑ Fisher	*Martes pennanti*
❑ Mink	*Mustela vison*
❑ Wolverine	*Gulo luscus*
❑ River otter	*Lutra canadensis*
❑ Pronghorn antelope	*Antilocapra americana*
❑ Showy Indian clover	*Trifolium amoenum*
❑ Yellow larkspur	*Delphinium luteum*

Investigation

All of the species listed above have been extirpated from Point Reyes National Seashore. Some of them have been extirpated from the entire state of California. What is meant by "extirpated"?

Why is this species extirpated in California?

What are the specific threats to this species habitat?

Why should we care about keeping this species in Point Reyes National Seashore or in California?

Name _____ Date _____

Activity Sheet

How to Positively Affect Land Habitats (continued)

Problem Solving

If you could create a "Recovery Plan" for your species in California, what three recommendations would you include in your report?

1.

2.

3.

Decision Making

National Park Service policy calls for restoring native species that have been eliminated as a result of human activity if:

> "adequate habitat exists to support them, and the species can be managed so as not to pose a serious threat to people or property outside the Park."

Based on this policy, place check marks next to the species you think could be restored at Point Reyes National Seashore.

Resolution

What three things could you do to increase the chances of a chosen species recovering in California?

1.

2.

3.

Name _____ Date _____

Activity Sheet

How to Positively Affect Seashore Habitats

Learn about some species of coastal dune habitats to understand how they function and how your actions will keep them healthier.

NPS Collection

Western Snowy Plover

Charadrius alexandrinus nivosus

A federally threatened species whose numbers have been decreasing due to a loss of suitable habitat, especially during nesting and fledgling periods. Snowy plovers require unstable, flat, open areas with thin ground cover. Introduced plants reduce shifting sand areas and increase habitat for predators of plover eggs and young.

Walter Knight, CA Academy of Sciences

Pink Sand Verbena

Abronia umbellata breviflora

This plant grows along dunes and back beaches. It has been replaced by European beach grass as the dominant vegetative species.

Brother Alfred Brousseau,
CA Academy of Sciences

European Beach Grass

Ammophila arenaria

This grass was brought to North America from Europe as a dune stabilizer. It tends to form dense mats of grass that prevent establishment of native species. Its dense growth captures sand and prevents natural movement of dunes.

Charles Webber, CA Academy of Sciences

Ice Plant

Carpobrotus edulis

Ice plant is a hardy plant able to withstand drought or being uprooted (for a short period of time). It grows low to the ground and blankets the dunes with its sprawling swollen leaves. Originally native to South Africa, this plant was used as roadside erosion control.

Activity Sheet

How to Positively Affect Seashore Habitats (continued)

Investigation

How is the western snow plover affected by European beach grass?

How is pink sand verbena affected by ice plant?

List three elements of an ideal coastal dune habitat:

1.

2.

3.

Resolution

Place check marks next to things you can do to help preserve coastal dunes.

- ❑ Volunteer to remove ice plant with a habitat restoration group.
- ❑ Plant European beach grass in my garden.
- ❑ Respect enclosures on beaches meant to protect western snowy plover nesting sites and fledglings (especially March through September).
- ❑ Play volleyball directly next to a western snowy plover nest.
- ❑ Respect pet restriction areas—leash dogs on all beaches with signs posted for western snowy plovers.
- ❑ Approach exclosure fencing to scare western snowy plovers off their nests.
- ❑ Walk close to the water in wet sand instead of the flat dry sand and driftwood before the dunes to avoid disturbing western snowy plover nests.
- ❑ Stick driftwood upright on beaches so predators such as ravens can get an opportunity to hunt western snowy plovers.

This following list is incomplete, but is meant to provide ideas for additional teaching resources.

Education and Reference Materials

Alden, Peter and Fred Heath. **Field Guide to California.** Alfred A. Knopf. 1998.

Benyus, Janine M. **The Field Guide to Wildlife Habitats.** Simon & Schuster. 1989.

Burt, William H. and Richard P. Grossenheider. **Mammals.** Houghton Mifflin. 1976.

Conant, Roger and Robert Stebbins, and Joseph Collins. Peterson **First Guides: Reptiles, and Amphibians, a simplified field guide to the snakes, turtles, frogs, lizards, and other reptiles and amphibians of North America.** Houghton Mifflin Company. 1991.

Day, John A. and Vincent J. Schaefer. Peterson **First Guides: Clouds and Weather, a simplified field guide to the atmosphere.** Houghton Mifflin Company. 1991.

Duensing, Edward and A.B. Millmoss. **Backyard and Beyond.** Fulcrum Publishing. 1992.

Evans, Jules G. **The Natural History of the Point Reyes Peninsula.** Point Reyes Natural History Association. 1993.

Gunzi, Christiane. **Tide Pool.** DK Publishing. 1998.

Halfpenny, James C. **Scat and Tracks of the Pacific Coast.** Falcon Press. 1999.

Horn, Elizabeth L. **Coastal Wildflowers of the Pacific Northwest.** Montana Press. 1993.

Latimer, Jonathan P. and Karen Stray Nolting. **Peterson Field Guides For Young Naturalists: Backyard Birds.** Houghton Mifflin Company. 1999.

Latimer, Jonathan P. and Karen Stray Nolting. **Peterson Field Guides For Young Naturalists: Birds of Prey.** Houghton Mifflin Company. 1999.

McConnaughey, Bayard and Evelyn. **Pacific Coast.** Alfred A. Knopf. 1998.

Murie, Olaus J. **Animal Tracks.** Houghton Mifflin. 1974.

Peterson, Roger Tory. Peterson **First Guides: Birds, a simplified field guide to the common birds of North America.** Houghton Mifflin Company. 1980.

Peterson, Roger Tory. **Western Birds.** Houghton Mifflin. 1990.

Sheldon, Ian. Seashore: **Northern and Central California.** Lone Pine Publishing. 1999.

Stebbins, Robert. **Reptiles and Amphibians.** Houghton Mifflin. 1985.

Internet Addresses

AmeriCorps Watershed Stewards Project
www.northcoast.com/~fishhelp/

Backyard Wildlife Habitat
www.nwf.org/habitats/index.html

California Coastal Commission
www.ceres.ca.gov/coastalcomm/web/

California Native Plant Society: Marin Chapter
www.marin.cc.ca.us/cnps/communities.html

Environmental Protection Agency: National Estuary Program
www.epa.gov/owow/estuaries/nep.html

Environmental Protection Agency: Oceans and Coastal Protection
www.epa.gov/owowwtr1/oceans/factsheets/fact5.html

Gulf of the Farallones National Marine Sanctuary
www.gfnms.nos.noaa.gov

Habitat Restoration Glossary
www.habitat-restoration.com/gloss.htm

Fish and Wildlife Invasive Species Program.
http://invasives.fws.gov/

Fish and Wildlife Service, Wetlands and Coastal Habitats
www.fws.gov/cep/coastweb.html

Habitat Restoration Information Center
www.habitat-restoration.com/index.html

Marin County Stormwater Pollution Prevention Program
www.mcstoppp.org

Marine Mammal Center
www.tmmc.org

National Wildlife Federation
http://nwf.org/nwf.endagered/index.html

Neighborhoods, Ecosystems, Biomes and Habitats
http://sln.fi.edu/tfi/units/life/habitat/habitat/html

Point Reyes National Seashore
http://www.nps.gov/pore

Poulsboro Marine Science Center and the Marine Science Society of the Pacific Northwest
http://poulsbomsc.org

Restore America's Estuaries
www.estuaries.org

Wildcare
www.wildcare.org

Workshops and Classes

Point Reyes National Seashore Association offers naturalist classes. Please call for a calendar and registration form.

PRNSA Field Seminars, Point Reyes National Seashore, Point Reyes Station, CA, 94956
(415) 663-1200

Grants and Awards

The Captain Planet Foundation: The mission of the Captain Planet Foundation is to facilitate and support hands-on environmental projects for children and youths. The foundation's objective is to encourage innovative programs that empower children around the world to work individually and collectively to solve environmental problems in their neighborhoods and communities.

The Captain Planet Foundation, One CNN Center, Atlanta, GA 30303
(404) 827-4130, ***www.turner.com/cpf***

Cottonwood Foundation: This foundation offers small grants to local community organizations (including school-based groups) that use volunteer energies to protect the environment and promote cultural diversity.

Cottonwood Foundation, Box 10803, White Bear Lake, MN 55110
www.pressenter.com/~cottonwd/

National Tree Trust: The Community Tree Planting Program of the National Tree Trust facilitates tree planting on public lands. The grants consist of one-year-old, regionally appropriate tree seedlings, two-gallon plastic containers, and a cash subsidy to underwrite the cost of potting medium.

National Tree Trust, Community Tree Planting Program, 1120 G Street NW, Suite 770, Washington, DC 20005
1 (800) 846-8733, ***www.nationaltreetrust.org/CTP.htm***

Youth Garden Grants: Each year the National Gardening Association awards 300 Youth Garden Grants to school, neighborhoods, and intergenerational programs throughout the United States. Each grant consists of an assortment of quality tools, seeds, and garden products generously contibuted by leading companies from the lawn and garden industry, and valued at more than $750.

National Gardening Association, 180 Flynn Avenue, Burlington, V, 05401
1 (800) 538-7476, ***www.nsta.org/programs/toyota.htm***

continued

W.K. Kellog Foundation: The W.K. Kellog Foundation is a non-profit organization whose mission is to apply knowledge to solve the problems of people. One of the ways the Foundation does this is by awarding educational grants in community-based service learning.

W.K. Kellogg Foundation, One Michigan Avenue East, Battle Creek, MI 49017-4058
(616) 968-1611, ***www.wkkf.org***